Chapter 3: Wiring

Chapter 3

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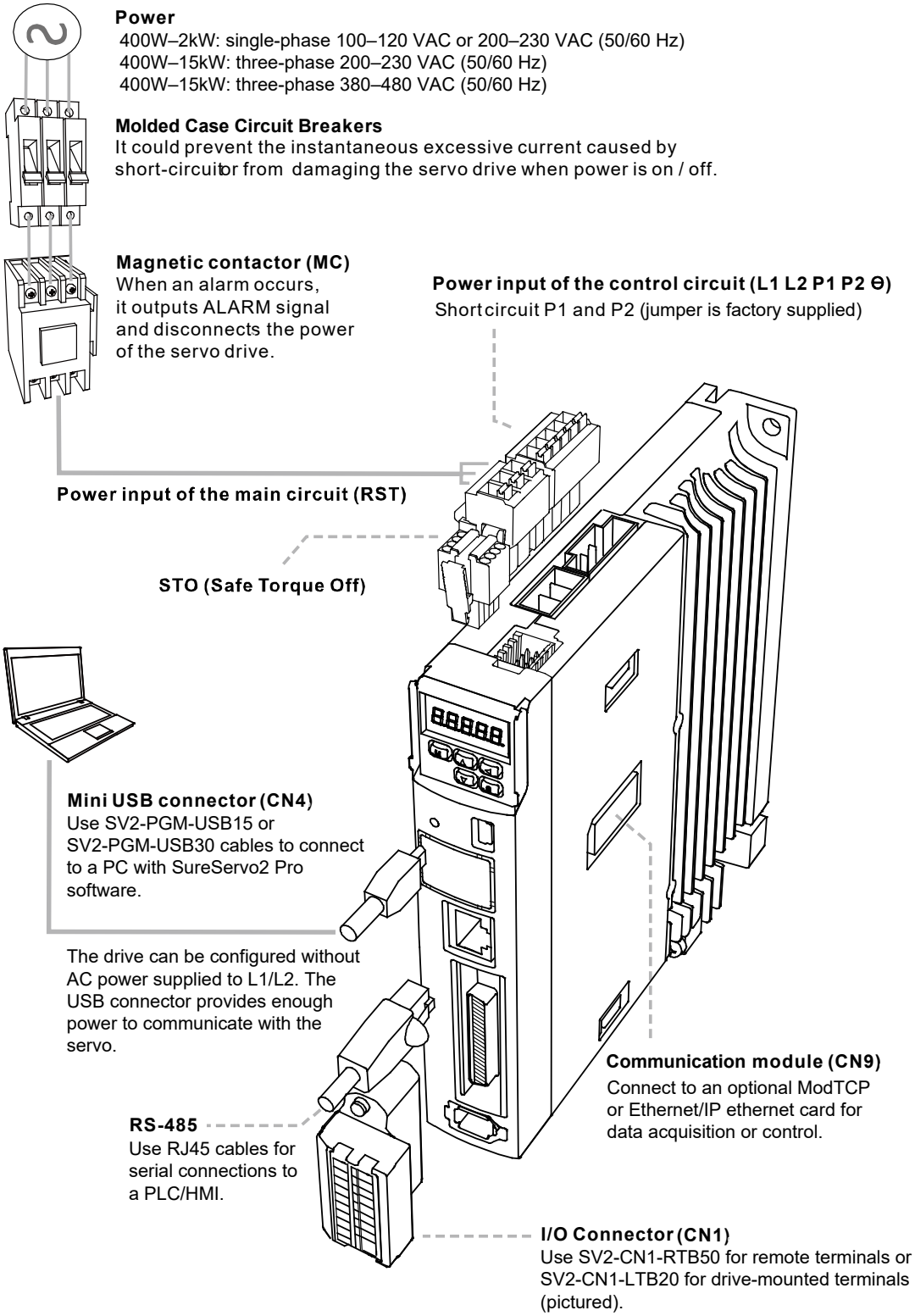
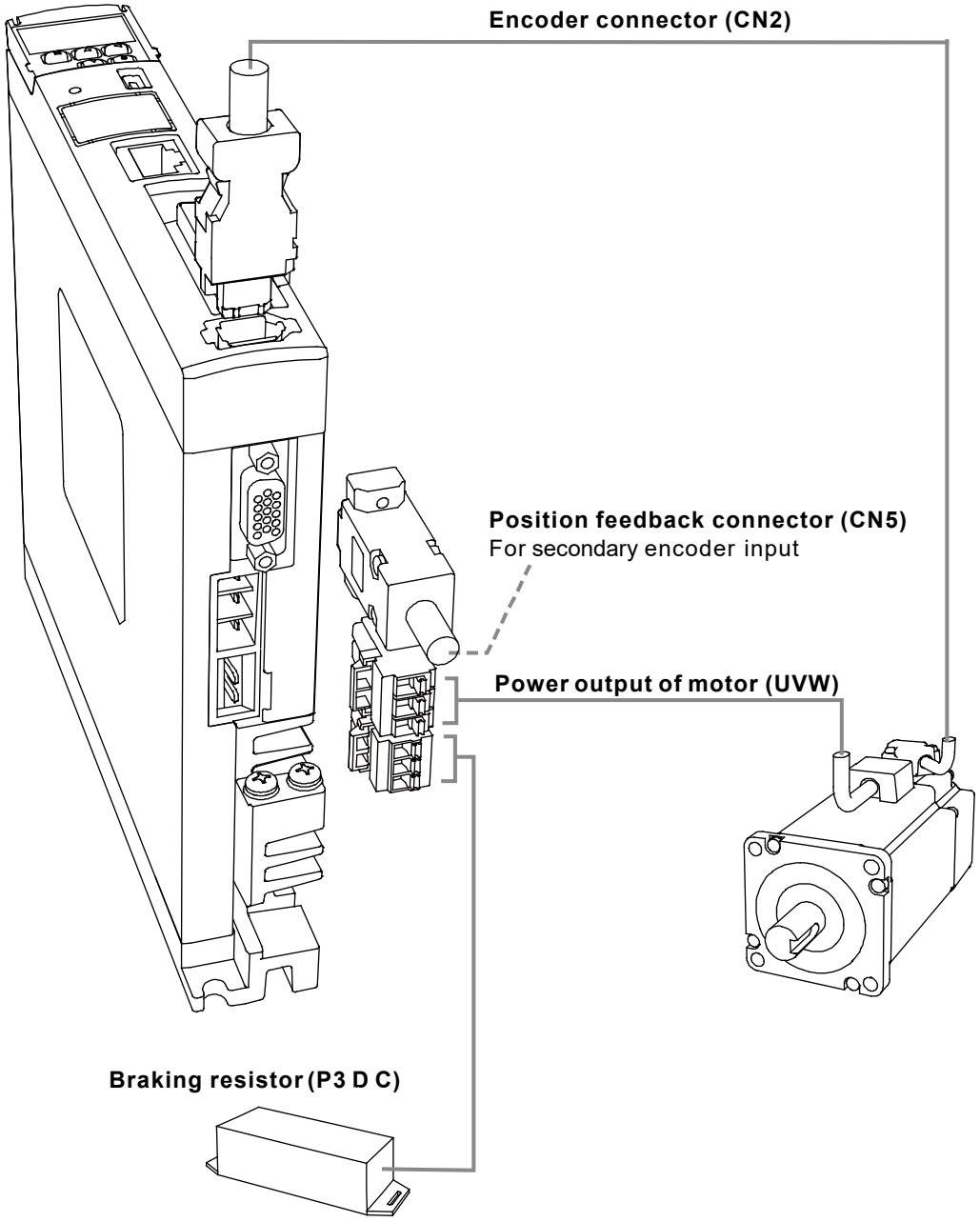
SureServo2™ Wiring

This chapter illustrates the power supply circuit, connectors, and wiring for each mode of the SureServo2.

3.1 - System Connection

3.1.1 - Connecting to Peripheral Devices





Installation safety precautions:

1) Make sure the power and wiring connections between the R, S, T, and L1, L2 are correct. Please refer to Appendix A Specifications in this user manual for the correct voltage input to avoid any damage to the servo drive and dangerous operating conditions.
2) Make sure the UVW terminal block is correctly wired to avoid abnormal operation of the motor.
3) When installing an external regenerative resistor, P3 and D contacts should be left open, and the external regenerative resistor should connect to P3 and C contacts. When using the built-in regenerative resistor, P3 and D contacts should be short-circuited, and P3 and C contacts should be left open.
4) When an alarm occurs or the system is under emergency stop status, please use DO.ALARM or DI.WARN to disconnect the power at the magnetic contactor (MC) so as to power off the servo drive.

3.1.2 - Connectors and Terminal Blocks

<table>
<tr><th>Symbol</th><th>Name</th><th>Description</th></tr>
<tr><td>L1c, L2c</td><td>Power input for the 110/230V control circuit</td><td>Connect to single-phase AC power (230V drives only). Please refer to the model specification for the proper input voltage.</td></tr>
<tr><td>24V, 0V</td><td>Power input for the 460V control circuit</td><td>Connect to 24VDC power (460V drives only).</td></tr>
<tr><td>P1, P2</td><td>Reserved</td><td>Short circuit P1 and P2 (there is a factory installed jumper).</td></tr>
<tr><td>R, S, T</td><td>Power input for the main circuit</td><td>Connect to AC power (please refer to the model specification for the proper input voltage). If using 1-phase power, connect to R and S.</td></tr>
<tr><td>U, V, W, FG</td><td>Motor power</td><td>Connect to the servo motor:
<table>
<tr><th>Symbol</th><th>Wire Color</th><th>Description</th></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">Three-phase main power cable for the motor.</td></tr>
<tr><td>V</td><td>White</td></tr>
<tr><td>W</td><td>Black</td></tr>
<tr><td>FG</td><td>Green</td><td>Connect to ground terminal for the servo drive.</td></tr>
</table></td></tr>
<tr><td>P3, D, C, ⊖</td><td>Regenerative resistor terminal or braking unit</td><td>
<table>
<tr><th>Usage</th><th>Connection</th></tr>
<tr><td>Use internal resistor</td><td>The contact between P3 and D should be short-circuited. The contact between P3 and C should be open.</td></tr>
<tr><td>Use external resistor</td><td>Connect P3 and C to the resistor and the contact between P3 and D should be open.</td></tr>
<tr><td>Use external braking unit</td><td>Connect the braking unit to P3 and ⊖ of the servo drive. The connection between P3 & D, and P3 & C should be opened.</td></tr>
</table></td></tr>
<tr><td>⏚</td><td>Ground terminal</td><td>Connect to the ground wire for the power and servo motor.</td></tr>
<tr><td>CN1</td><td>I/O connector</td><td>Connect to the host controller. Please refer to section 3.4 for more information.</td></tr>
<tr><td>CN2</td><td>Connector for motor encoder</td><td>Connect to the encoder. Please refer to section 3.6 for more information.</td></tr>
<tr><td>CN3</td><td>Connector of RS-485</td><td>For RS-485. Please refer to section 3.7 for more information.</td></tr>
<tr><td>CN4</td><td>Mini USB connector</td><td>Connect to PC or laptop for use with SureServo2 Pro software. Please refer to section 3.8 for more information. The USB connector provides enough power to configure the drive without having AC power supplied.</td></tr>
<tr><td>CN5</td><td>Position feedback connector (Optional)</td><td>Connect to external linear scale or encoder for full-closed loop and motor feedback. Please refer to section 3.9 for more information. Suggested cables: ZL-HD15M-CBL-DB15F (with ZIPlink ZL-RTB-DB15 breakout module) or ZL-HD15M-CBL-2P HD15 to flying lead cable.</td></tr>
<tr><td>CN9</td><td>Expansion module</td><td>Connect to EtherNet IP or Modbus TCP communication modules.</td></tr>
<tr><td>CN10</td><td>STO</td><td>Connect to STO plug or safety circuit. Please refer to section 3.10 for more information.</td></tr>
</table>

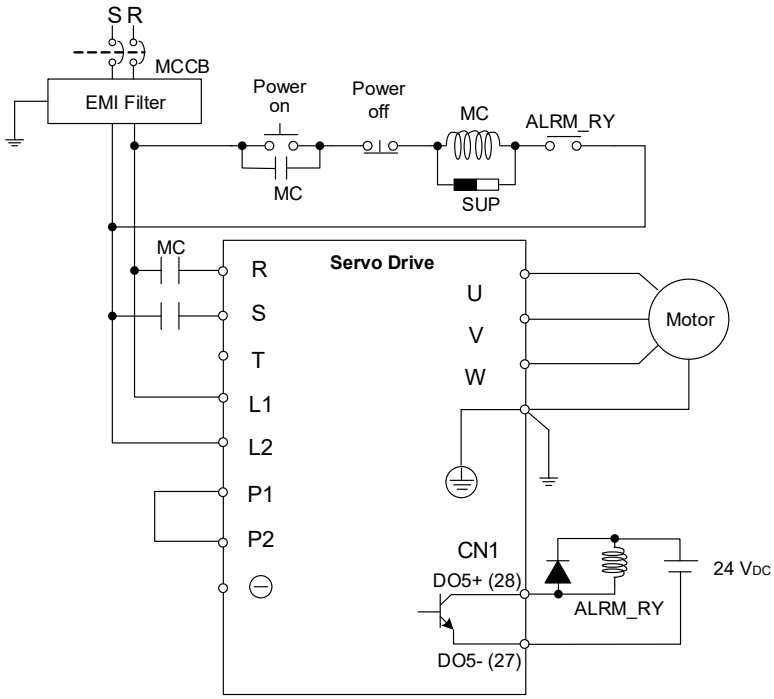
Pay special attention to the following when connecting the wiring:

1) When the power is off, do not touch R, S, T and U, V, W since the capacitor inside the servo drive can still contain a dangerously large amount of electric charge. Wait until the charging light is off.
2) Separate R, S, T and U, V, W from other wires. The separation should be at least 30 cm (11.8 inches).
3) If the connection cable for CN2 (encoder) or CN5 (position feedback) is not long enough, please use a 26 AWG shielded twisted-pair cable that conforms to UL2464 specifications. If it is over 20 meters (65.62 ft), please choose a signal cable with diameter two times greater than 26 AWG to avoid excessive signal attenuation.
4) When using RS-485 please use shielded twisted-pair cable to ensure the communication quality.
5) When selecting the wires, please refer to section 3.2.4.
6) Do not use any external capacitors or it might damage the servo drive.

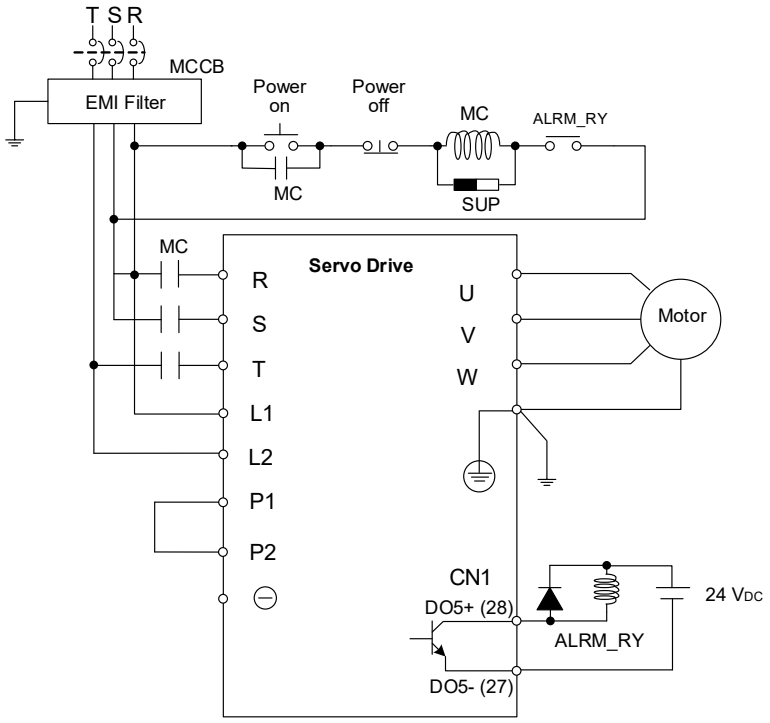
3.1.3 - Wiring for Power Supply

There are two methods for wiring the power supply: single-phase and three-phase. In the diagram below, Power On is normally open, Power Off and ALRM_RY are normally closed. DO5 function (P2.022) is set to 0x0007 by default (normally closed output). In the two diagrams below, set DO5 function to 0x0107 (normally open output). MC (magnetic contactor) is the power relay and the contact for the main power circuit.

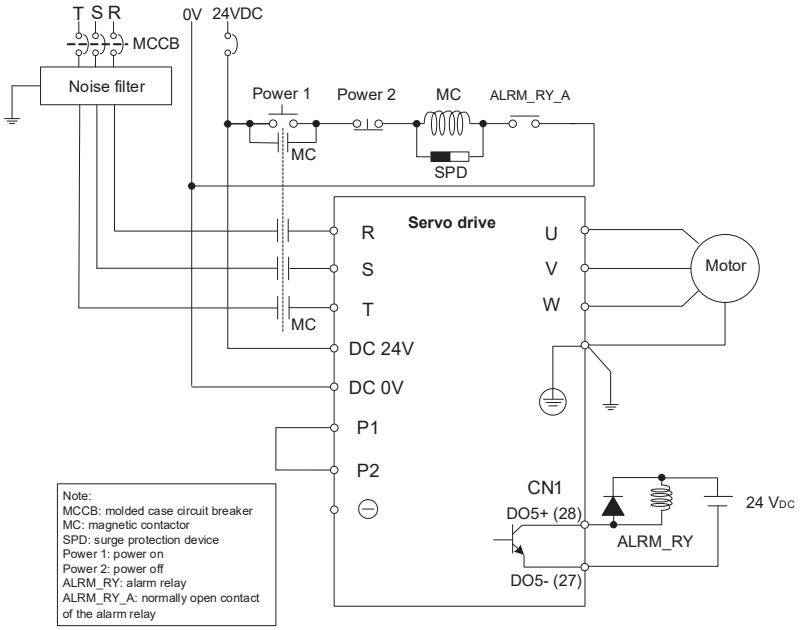
Wiring Method for Single-phase Power Supply



Wiring Method for Three-phase Power Supply (110/230V systems)



Wiring Method for Three-phase Power Supply (460V systems)



Note: The CN1 DO5 Digital Output shown in the diagram is the default Alarm Output for SureServo2 and is defaulted to normally closed.

3.2 - Cables and Connectors for SureServo2

110/230V Motors						
Motor	**Motor Description**	**Power Cable**	**Replacement Power Connector**	**Encoder Cable**	**Replacement Encoder Connector**	**Drive End Replacement Encoder Connector**
SV2L-201N	Motor, 0.1 kW, Low intertia	SV2C-PA18-xxxN	SV2C-PA-CON	SV2C-E122-xxxN	SV2C-E1-CON	SV2C-E3-CON
SV2L-202N	Motor, 0.2 kW, Low inertia					
SV2L-204N	Motor, 0.4 kW, Low inertia					
SV2L-207N	Motor, 0.75 kW, Low inertia					
SV2L-210N	Motor, 1kW, Low inertia	SV2C-PC16-xxxN	SV2C-PC-CON	SV2C-E222-xxxN	SV2C-E2-CON	
SV2M-210N	Motor, 1kW, Med inertia	SV2C-PC12-xxxN				
SV2M-215N	Motor, 1.5 kW, Med inertia					
SV2M-220N	Motor, 2kW, Med inertia	SV2C-PD12-xxxN	SV2C-PD-CON			
SV2M-230N	Motor, 3kW, Med inertia					
SV2H-245N	Motor, 4.5 kW, High inertia	SV2C-PD08-xxxN				
SV2H-255N	Motor, 5.5 kW, High inertia	SV2C-PF06-xxxx	SV2C-PF-CON			
SV2H-275N	Motor, 7.5 kW, High inertia					
SV2H-2B0N	Motor, 11 kW, High inertia					
SV2H-2F0N	Motor, 15 kW, High inertia	SV2C-PF04-xxxx				
SV2L-201B	Motor, 0.1 kW, Low inertia	SV2C-PB18-xxxB	SV2C-PB-CON	SV2C-E122-xxxN	SV2C-E1-CON	SV2C-E3-CON
SV2L-202B	Motor, 0.2 kW, Low inertia					
SV2L-204B	Motor, 0.4 kW, Low inertia					
SV2L-207B	Motor, 0.75 kW, Low inertia					
SV2L-210B	Motor, 1kW, Low inertia	SV2C-PC16-xxxB	SV2C-PC-CON	SV2C-E222-xxxN	SV2C-E2-CON	
SV2M-210B	Motor, 1kW, Med inertia	SV2C-PC12-xxxB				
SV2M-215B	Motor, 1.5 kW, Med inertia					
SV2M-220B	Motor, 2kW, Med inertia	SV2C-PD12-xxxB	SV2C-PD-CON			
SV2M-230B	Motor, 3kW, Med inertia					
SV2H-245B	Motor, 4.5 kW, High inertia	SV2C-PD08-xxxB				
SV2H-255B*	Motor, 5.5 kW, High inertia	SV2C-PF06-xxxx + SV2C-B120-xxxx	SV2C-PF-CON			
SV2H-275B*	Motor, 7.5 kW, High inertia					
SV2H-2B0B*	Motor, 11 kW, High inertia					
SV2H-2F0B*	Motor, 15 kW, High inertia	SV2C-PF04-xxxx + SV2C-B120-xxxx				

** Brake wiring is separate from the motor power cable for 5.5–15 kW motors. Brake power cable SV2C-B120-xxxx is required. The replacement connector for the brake cable is SV2C-B1-CON.*
For 100W to 4.5 kW motors the brake wiring is inside the motor power cable and no brake power cable is required.

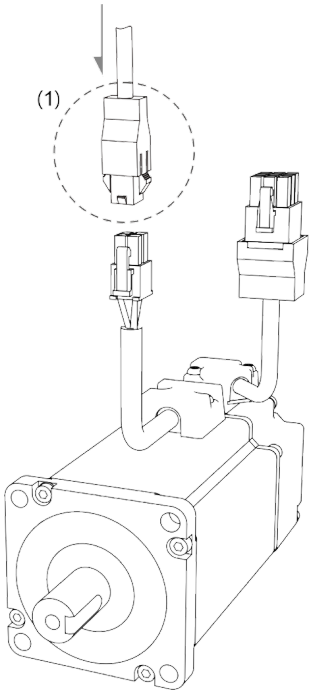
NOTE: Cable specifications (including diameter and bend radius) available in Appendix B.

460V Motors						
Motor	***Motor Description***	***Power Cable***	***Replacement Power Connector***	***Encoder Cable***	***Replacement Encoder Connector***	***Drive End Replacement Encoder Connector***
SV2L-404N	Motor, 0.4 kW, Low inertia	SV2C-PA18-xxxN	SV2C-PA-CON	SV2C-E122-xxxN	SV2C-E1-CON	SV2C-E3-CON
SV2L-407N	Motor, 0.75 kW, Low inertia					
SV2L-410N	Motor, 1kW, Low inertia	SV2C-PC16-xxxN	SV2C-PC-CON	SV2C-E222-xxxN	SV2C-E2-CON	
SV2M-410N	Motor, 1kW, Med inertia					
SV2L-415N	Motor, 1.5 kW, Low inertia					
SV2L-420N	Motor, 2kW, Low inertia					
SV2H-430N	Motor, 3kW, High inertia	SV2C-PD12-xxxN	SV2C-PD-CON			
SV2H-445N	Motor, 4.5 kW, High inertia	SV2C-PD08-xxxN				
SV2H-455N	Motor, 5.5 kW, High inertia					
SV2H-475N	Motor, 7.5 kW, High inertia					
SV2H-4B0N	Motor, 11 kW, High inertia	SV2C-PF08-xxxx	SV2C-PF-CON			
SV2H-4F0N	Motor, 15 kW, High inertia					
SV2L-404B	Motor, 0.4 kW, Low inertia	SV2C-PB18-xxxB	SV2C-PB-CON	SV2C-E122-xxxN	SV2C-E1-CON	SV2C-E3-CON
SV2L-407B	Motor, 0.75 kW, Low inertia					
SV2L-410B	Motor, 1kW, Low inertia	SV2C-PC16-xxxB	SV2C-PC-CON	SV2C-E222-xxxN	SV2C-E2-CON	
SV2M-410B	Motor, 1kW, Med inertia					
SV2L-415B	Motor, 1.5 kW, Low inertia					
SV2L-420B	Motor, 2kW, Low inertia					
SV2H-430B	Motor, 3kW, High inertia	SV2C-PD12-xxxB	SV2C-PD-CON			
SV2H-445B	Motor, 4.5 kW, High inertia	SV2C-PD08-xxxB				
SV2H-455B	Motor, 5.5 kW, High inertia					
SV2H-475B	Motor, 7.5 kW, High inertia					
SV2H-4B0B*	Motor, 11 kW, High inertia	SV2C-PF08-xxxx + SV2C-B120-xxxx	SV2C-PF-CON			
SV2H-4F0B*	Motor, 15 kW, High inertia					

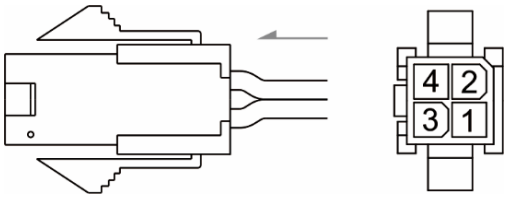
** Brake wiring is separate from the motor power cable for 11–15 kW motors. Brake power cable SV2C-B120-xxxx is required. The replacement connector for the brake cable is SV2C-B1-CON. For 100W to 7.5 kW motors the brake wiring is inside the motor power cable and no brake power cable is required.*

NOTE: Cable specifications (including diameter and bend radius) available in Appendix B.

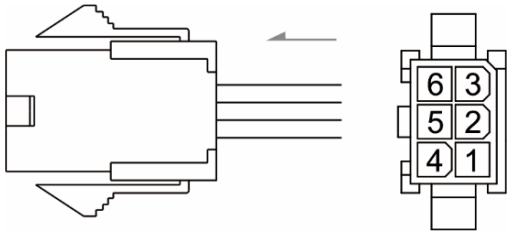
3.2.1 - UVW Connectors for the SureServo2 Drive



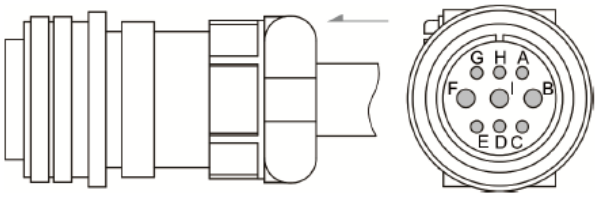
(1) Refer to the table below for UVW connector specifications:

Motor Model	UVW Connector
SV2L-201N SV2L-202N SV2L-204N SV2L-207N SV2L-404N SV2L-407N	

Pin Assignment for SV2C-PA-CON					
U (Red)	V (White)	W (Black)	Case Ground (Green)	Brake 1 (Yellow)	Brake 2 (Blue)
1	2	3	4	n/a	n/a

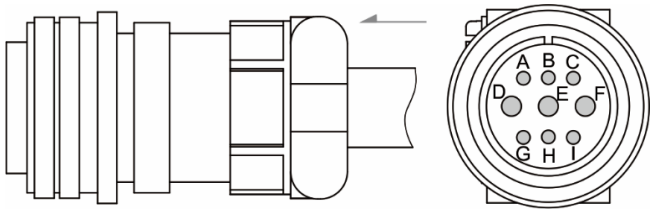
Motor Model	UVW Connector
SV2L-201B SV2L-202B SV2L-204B SV2L-207B SV2L-404B SV2L-407B	

Pin Assignment for SV2C-PB-CON					
U (Red)	V (White)	W (Black)	Case Ground (Green)	Brake 1 (Yellow)	Brake 2 (Blue)
1	2	4	5	3	6

Motor Model	UVW Connector
SV2L-210N SV2L-210B SV2M-210N SV2M-210B SV2M-215N SV2M-215B SV2L-410N SV2L-410B SV2M-410N SV2M-410B SV2L-415N SV2L-415B SV2L-420N SV2L-420B	

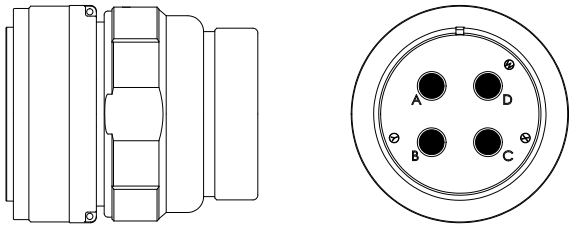
Pin Assignment for SV2C-PC-CON

U (Red)	V (White)	W (Black)	Case Ground (Green)	Brake 1 (Yellow)	Brake 2 (Blue)
F	I	B	E	G	H

Motor Model	UVW Connector
SV2M-220N SV2M-220B SV2M-230N SV2M-230B SV2H-245N SV2H-245B SV2H-430N SV2H-430B SV2H-445N SV2H-445B SV2H-475N SV2H-475B	

Pin Assignment for SV2C-PD-CON

U (Red)	V (White)	W (Black)	Case Ground (Green)	Brake 1 (Yellow)	Brake 2 (Blue)
D	E	F	G	A	B

Motor Model	UVW Connector
SV2H-255N SV2H-255B SV2H-275N SV2H-275B SV2H-2B0N SV2H-2B0B SV2H-2F0N SV2H-2F0B SV2H-4B0N SV2H-4B0B SV2H-4F0N SV2H-4F0B	

Pin Assignment for SV2C-PF-CON

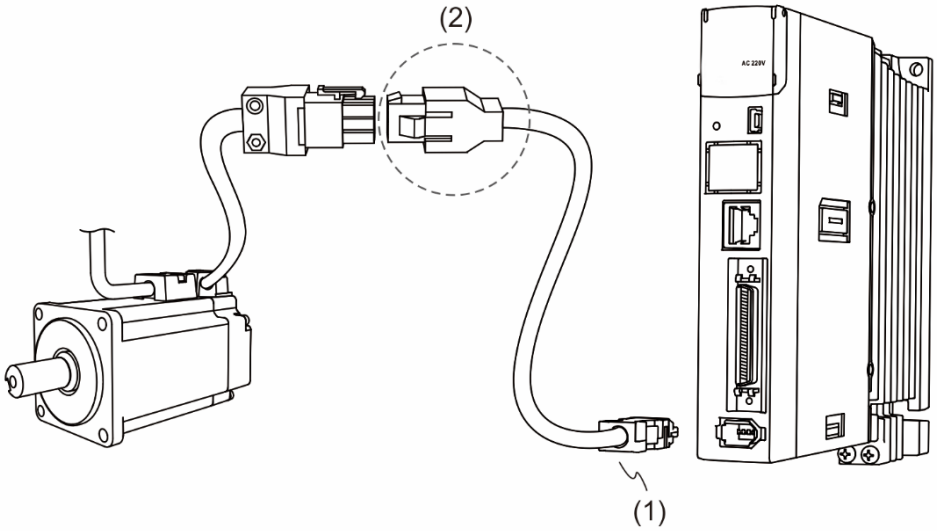
U (Red)	V (White)	W (Black)	Case Ground (Green)
A	B	C	D

Wire selection: please use a 600V PVC cable. If it is longer than 30 meters, refer to the voltage drop (wire impedance) to select the cable size. See section 3.2.4 for more information on the separate brake cable (SV2C-B120-xxxx) required for 5.5 kW – 15kW SV2x-2xxx series brake motors, or 11kW–15kW SV2x-4xxx series brake motors.

NOTE: The brake coil has no polarity. Its pin symbols are Brake 1 and Brake 2.

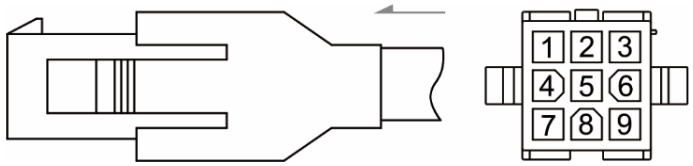
NOTE: Power supply for the brake is 24VDC. Do not share the same power supply with control signals.

3.2.2 - Specification for the Encoder Connector

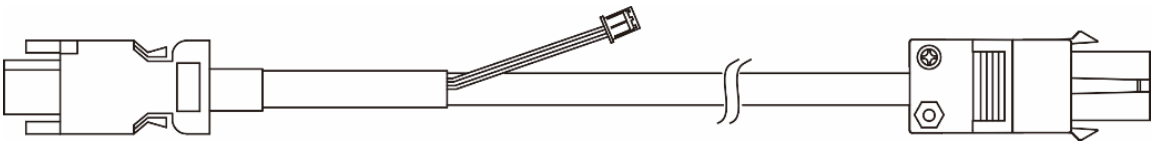


1) CN2 connector (p/n SV2C-E3-CON)
2) Quick connector (male)

NOTE: The diagram shows the connection between the servo drive and the encoder and is not drawn to scale. The specification is subject to change depending on the selected servo drive and motor models.

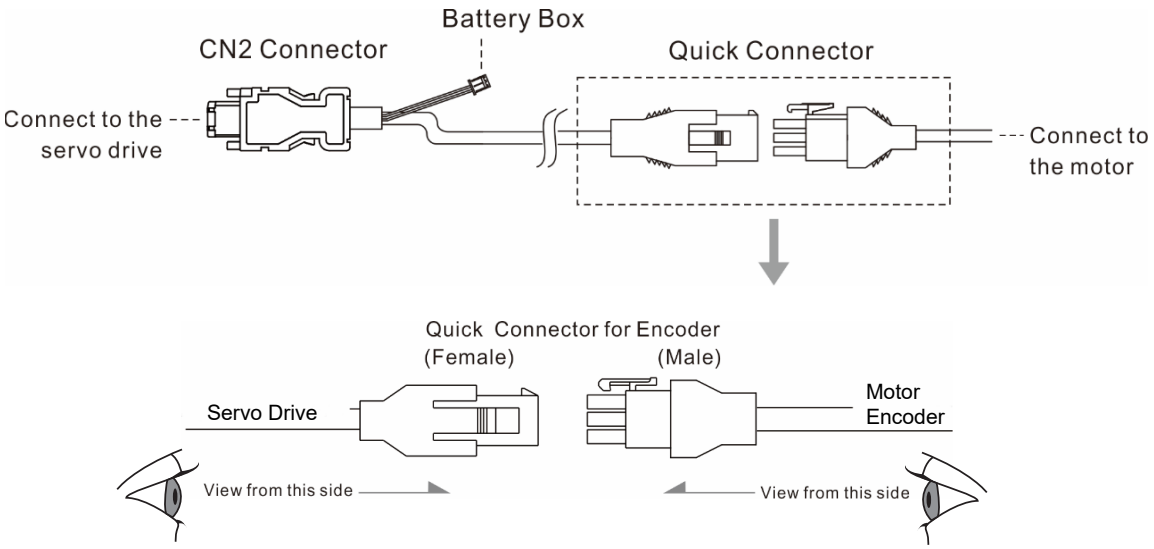
Motor Model	Quick Connector (Male) SV2C-E1-CON
SV2L-201N SV2L-202N SV2L-204N SV2L-207N SV2L-201B SV2L-202B SV2L-204B SV2L-207B SV2L-404N SV2L-404B SV2L-407N SV2L-407B	

Specification and Pin assignment for the absolute encoder connector:



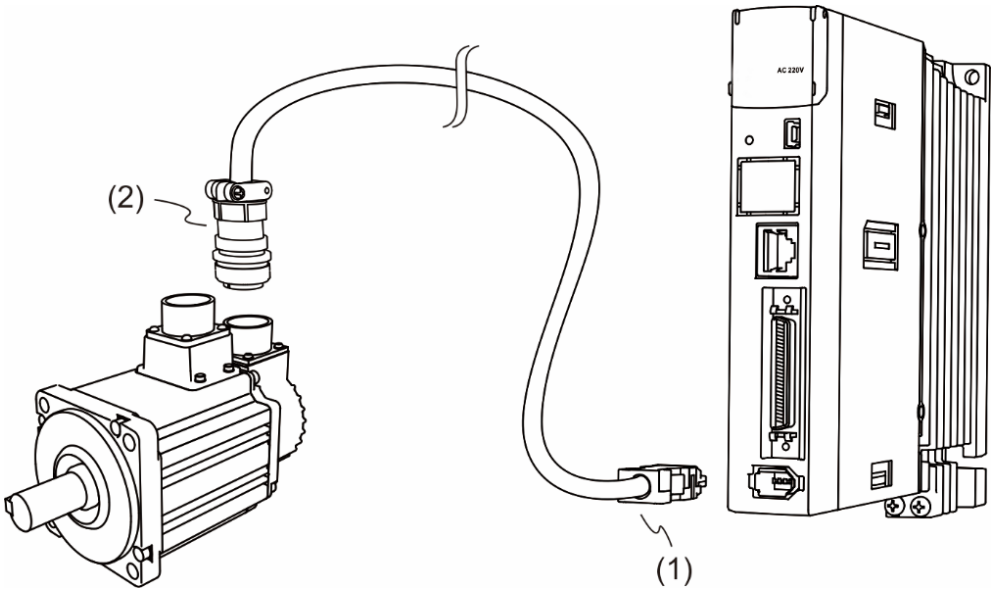
Connection method:

***WARNING!** Failure to follow the wiring instructions below could result in battery explosion!*

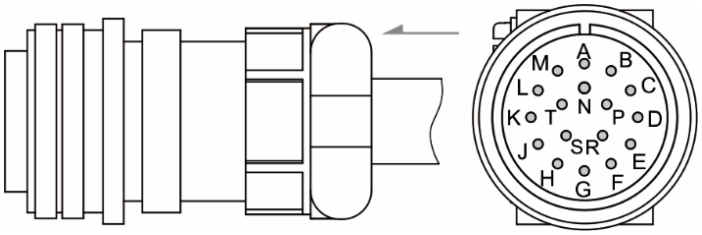


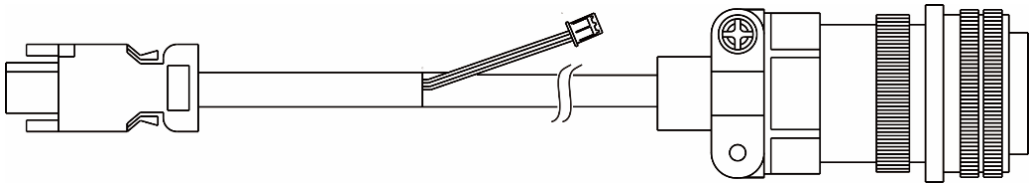
1	2	3		3	2	1
White T+	Red BAT+	Reserved		Reserved	Black BAT+	White T+
4	**5**	**6**		**4**	**5**	**4**
White/Red T-	Black BAT-	Reserved		Reserved	Red BAT-	White/Red T-
7	**8**	**9**		**9**	**8**	**7**
Brown DC+5V	Blue GND	Shield		Shield	Blue GND	Brown DC+5V

Encoder connection: Military connector



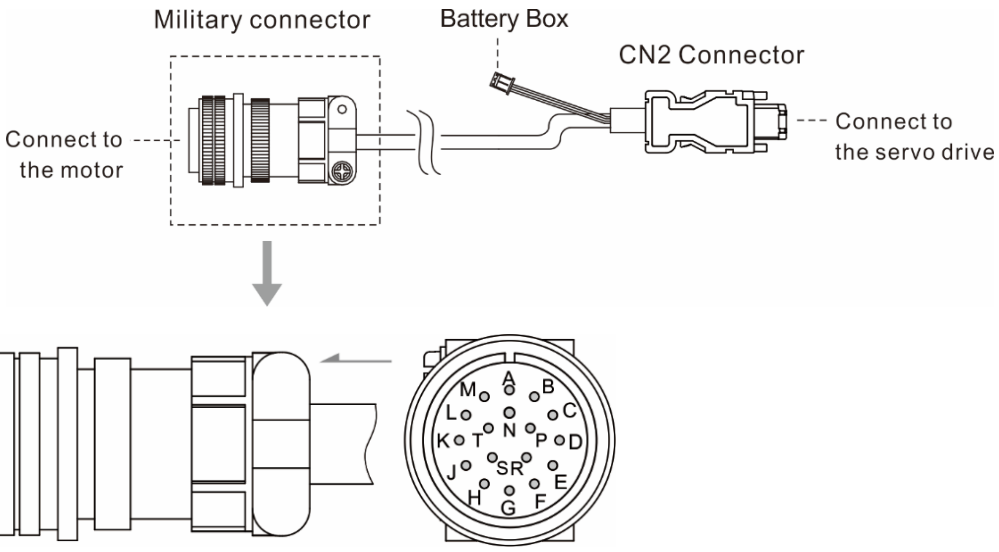
NOTE: the diagram shows the connection between the servo drive and the encoder and is not drawn to scale. The specification is subject to change according to the selected servo drive and motor models.

Motor Model	Military Connector
All 1kW to 15kW motors	



Connection method:

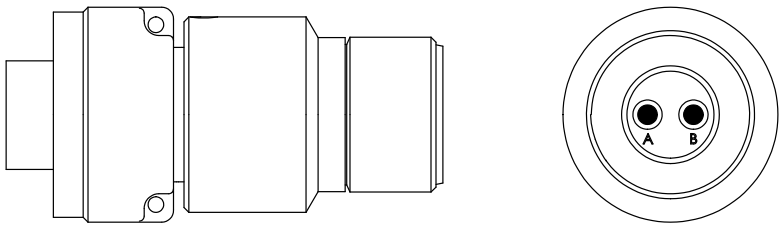
***WARNING!** Failure to follow the wiring instructions below could result in battery explosion!*



Pin Number	Symbol	Color
A	T+	White
B	T-	White / Red
C	BAT+	Red
D	BAT-	Black
S	DC+5V	Brown
R	GND	Blue
L	BRAID SHIELD	–

3.2.3 - Brake Power Cable and Connector

Pin assignments for brake power cable (SV2C-B120-xxxx) and connector (SV2C-B1-CON).



Pin Number	Symbol	Color
A	BR-	Black
B	BR+	Red

NOTE: The brake coil has no polarity. Its pin symbols are Brake 1 and Brake 2.

NOTE: Power supply for the brake is 24VDC. Do not share the same power supply with control signals.

3.2.4 - Wire selection

If you are not using an AutomationDirect motor power cable, please adhere to the cable specs below when selecting your own cable. The circuit protection values below for RST are recommended values for applications using full rated current of the motor and best protection. The values are for Class CC and Class J fuses or circuit breaker. For maximum circuit protection values see "2.5 - Specifications for the Circuit Breaker and Fuse" on page 2–6.

NOTE: The shield should connect to the ⏚ terminal. When wiring, please use the wires suggested in this section to avoid danger.

110/230 V Drives								
Servo Drive Model	L1C L2C		RST			P1 P2	P3 C	UVW (motor)
	Wire Size mm^2 (AWG)	Fusing	Voltage Level	Wire Size mm^2 (AWG)	Circuit Protection (A)	Wire Size mm^2 (AWG)	Wire Size mm^2 (AWG)	Wire Size mm^2 (AWG)
SV2A-2040	0.8 (18AWG)	5A breaker 6A fuse	110-120 VAC 1-phase	1.3 (16AWG)	8	0.8 (18AWG)	0.8 (18AWG)	0.8 (18AWG)
			200-230 VAC 1-phase	1.3 (16AWG)	10			
			200-230 VAC 3-phase	1.3 (16AWG)	5			
SV2A-2075			110-120 VAC 1-phase	2.1 (14AWG)	15	0.8 (18AWG)	0.8 (18AWG)	0.8 (18AWG)
			200-230 VAC 1-phase	3.3 (12AWG)	16			
			200-230 VAC 3-phase	2.1 (14AWG)	10			
SV2A-2150			110-120 VAC 1-phase	3.3 (12AWG)	20	1.3 (16AWG)	0.8 (18AWG)	3.3 (12AWG)
			200-230 VAC 1-phase	3.3 (12AWG)	20			
			200-230 VAC 3-phase	2.1 (14AWG)	15			
SV2A-2200			110-120 VAC 1-phase	5.3 (10AWG)	30	2.1 (14AWG)	1.3 (16AWG)	3.3 (12AWG)
			200-230 VAC 1-phase	5.3 (10AWG)	30			
			200-230 VAC 3-phase	3.3 (12AWG)	20			
SV2A-2300			200-230 VAC 3-phase	5.3 (10AWG)	30	2.1 (14AWG)	2.1 (14AWG)	3.3 (12AWG)
SV2A-2550			200-230 VAC 3-phase	8.4 (8AWG)	40	5.3 (10AWG)	3.3 (12AWG)	13.3 (6AWG)
SV2A-2750			200-230 VAC 3-phase	8.4 (8AWG)	40	8.4 (8AWG)	3.3 (12AWG)	13.3 (6AWG)
SV2A-21F0	2.1 (14AWG)		200-230 VAC 3-phase	21.2 (4AWG)	70	13.3 (6AWG)	8.4 (8AWG)	21.2 (4AWG)

460V Drives							
Servo Drive Model	24VDC, 0V		RST			P1, P2, P3, D, C, ⊖	UVW (motor)
	Wire Size mm^2 (AWG)	Fusing	Voltage Level	Wire Size mm^2 (AWG)	Circuit Protection (A)	Wire Size mm^2 (AWG)	Wire Size mm^2 (AWG)
SV2A-4040	0.82 (18AWG)	3A	380–480 VAC 3-phase	0.82 (18AWG)	3	2.1 (14AWG)	0.82 (18AWG)
SV2A-4075					5	3.3 (12AWG)	
SV2A-4150					6	5.3 (10AWG)	1.3 (16AWG)
SV2A-4200		5A		1.3 (16AWG)	10		
SV2A-4300				2.1 (14AWG)	15	8.4 (8AWG)	2.1 (14AWG)
SV2A-4550				5.3 (10AWG)*	25		5.3 (10AWG)
SV2A-4750				8.4 (8AWG)*	35	13.6 (6AWG)	
SV2A-41F0		7A		13.6 (6AWG)*	50	21.2 (4AWG)	8.4 (8AWG)

** Ring lugs recommended*

Encoder Cable:

Use the wires specified below when wiring encoders:

Servo Drive Model	Encoder Cable - Wire Diameter (AWG)			
	Wire Size	Number	Specification	Standard Length
All	0.324 mm^2-2C (22AWG–2C) + 0.205 mm^2–2P (24AWG–2P)	2C + 2P	UL2464	L = 3–20 m (9.84–65.6 ft)

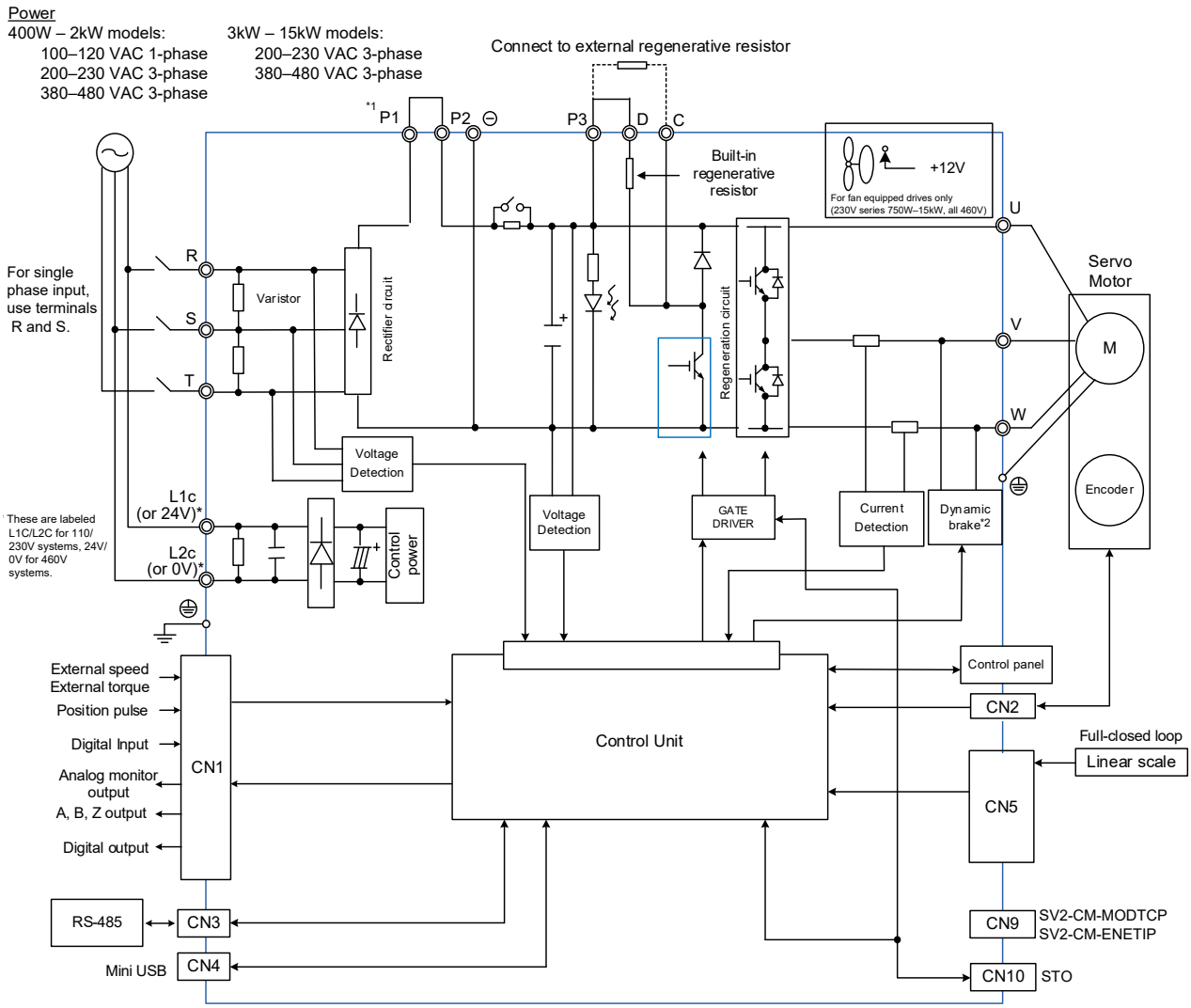
NOTE: Use shielded twisted-pair cable when wiring the encoder to reduce noise interference. The shield should connect to the ⏚ terminal.

Brake Cable:

Use the wires specified below when wiring the external brake cable:

Servo Drive Model	Encoder Cable - Wire Diameter (AWG)	
	Wire Size	Number
SV2A-2550 SV2A-2750 SV2A-2F00 SV2A-4F00	20AWG	2 wires

3.3 - Wiring Diagram for the Servo System



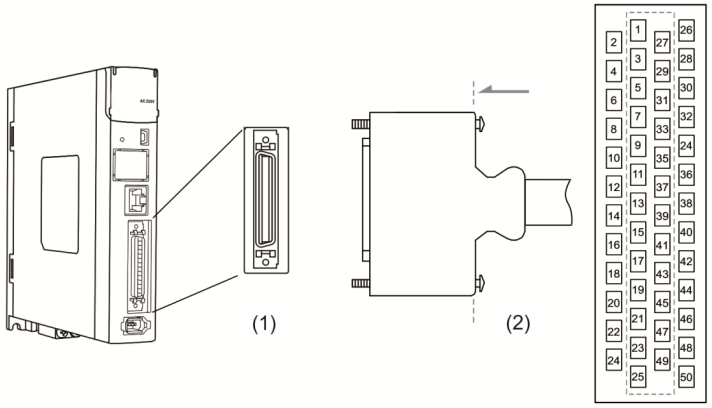
Notes:

1) Short circuit P1 and P2 as illustrated in the diagram (factory supplied jumper comes with the drive).
2) The Dynamic Brake is a relay which shorts phases V and W together.

3.4 - Wiring for CN1 (I/O signal)

3.4.1 - CN1 I/O connector

The SureServo2 provides 10 user-defined digital input (DI) points and 6 digital output (DO) points to provide highly flexible communication between the servo drive and the controller. For more information, please refer to section 3.5. In addition, differential type output signals for encoder A+, A-, B+, B-, Z+, and Z- are provided. Analog torque command input, analog speed/position command input, pulse position input are also available. The pin assignments are shown below:



1) CN1 connector (Female)
2) CN1 connector (Male)

Pin Assignment:

Pin	Signal	Function	Pin	Signal	Function	Pin	Signal	Function
1	DO4+	Digital output	18	T_REF	Analog torque input	35	PULL HI_S (Sign)	External power input of Sign pulse
2	DO3-	Digital output	19	GND	Analog input signal ground	36	SIGN	Position sign (+)
3	DO3+	Digital output	20	NC[1]	Not in use. Do not connect.	37	/SIGN	Position sign (-)
4	DO2-	Digital output	21	OA	Encoder A pulse output	38	DI10	Digital input
5	DO2+	Digital output	22	/OA	Encoder /A pulse output	39	PULL HI_P (Pulse)	External power input of pulse
6	DO1-	Digital output	23	/OB	Encoder /B pulse output	40	DO6-	Digital output
7	DO1+	Digital output	24	/OZ	Encoder /Z pulse output	41	/PULSE	Position pulse (-)
8	DI4-	Digital input	25	OB	Encoder B pulse output	42	V_REF	Analog command input speed (+)
9	DI1-	Digital input	26	DO4-	Digital output	43	PULSE	Position pulse (+)
10	DI2-	Digital input	27	DO5-	Digital output	44	GND	Analog input signal ground
11	COM+[2]	Power input (24 V ± 10%)	28	DO5+	Digital output	45	NC[1]	Not in use. Do not connect.
12	GND	Analog input signal ground	29	DI9-	Digital input	46	DO6+	Digital output
13	GND	Analog input signal ground	30	DI8-	Digital input	47	NC[1]	Not in use. Do not connect.
14	NC[1]	Not in use. Do not connect.	31	DI7-	Digital input	48	OCZ	Encoder Z pulse open-collector output
15	MON2	Analog monitor output 2	32	DI6-	Digital input	49	NC[1]	Not in use. Do not connect.
16	MON1	Analog monitor output 1	33	DI5-	Digital input	50	OZ	Encoder Z pulse line-driver output
17	NC[1]	Not in use. Do not connect.	34	DI3-	Digital input			

1: NC represents "No connection." Do not connect to NC or it may damage the drive.
2: COM+ can be wired to +24VDC or 0VDC determined by the use of a sinking or sourcing switch or sensor. See section 3.5.4

3.4.2 - Signal Explanation for Connector CN1

The following table details the signals listed in the previous section.

General signals

Signal		Pin No.	Function	Wiring Method
Analog command (Input)	V_REF	42	1) When motor speed command is set to -10V to +10V, it means the rotation speed is -3000 to +3000 r/min (default). You can set the corresponding range with parameters. 2) When motor position command is set to -10V to +10V, it means the range of the rotation position is -3 to +3 revolutions (default).	C1
	T_REF	18	When motor torque command is set to -10V to +10V, it means the rated torque is -100% to +100%.	C1
Analog Monitor (output)	MON1 MON2	16 15	The operation status of motor can be displayed in analog voltage, such as speed and current. This servo drive provides 2 output channels. You can select the data to be monitored with parameter P0.003. This signal is based on the power ground. The analog output resolution is 10-bit.	C2
Position Pulse (input)	PULSE /PULSE	43 41	Position pulse can be sent by Line Driver (single-phase max. frequency 4MHz) or open-collector (single-phase max. frequency 200 KHz). Three command types can be selected with P1.000, CW/CCW pulse, pulse and direction, and A/B pulse. If open collector type is used when sending position pulses, CN1 should be connected to an external power supply for pull high.	C3/C4
	SIGN /SIGN	36 37		
	PULL HI_P PULL HI_S	39 35		
Position Pulse (output)	OA/OA	21 22	Encoder signal output A, B, and Z (Line Driver).	C9/C10
	OB/OB	25 23		
	OZ/OZ	50 24		
	OCZ	48	Encoder Z pulse output (Open-collector). Max User-supplied voltage is 30VDC. Use a resistor to limit the output current to a maximum of 50mA.	C11
Power	COM+	11	NPN: COM+ is for DI voltage input and requires external power supply (24V ±10%). PNP: COM+ is for DI voltage input (negative end) and also requires external power supply (24V ±10%).	-
	GND	12, 13, 19, 44	GND for analog signal and differential signal output	
Other	NC	14	No connection. This is for internal use only. Do not connect to NC, or it may damage the servo drive.	

There are various operation modes available (refer to section 6.1) and the I/O configuration differs for each mode. The SureServo2 provides user-defined I/O for you to set functions according to the application requirements. Refer to "8.4.9 - Digital Input (DI) Function Assignments"and "8.4.10 - Digital output (DO) Function Assignments". The default DI/DO signal configuration for each operation mode includes the most commonly used functions and meets the requirements for general applications. The suggested DI and DO functions on the next page can be automatically assigned during configuration download using P1.001 (nibble U).

See the table on the next page for the suggested DI signal of each control mode:

Control Mode

DI	Control Mode								
	PT	PR	S/Sz	T/Tz	PT-S	PT-T	PR-S	PR-T	S-T
	Default DI Assignment when P1.001.U=1								
1	0x01	0x01	0x01	0x01	0x01	0x01	0x01	0x01	0x01
	SON	SON	SON	SON	SON	SON	SON	SON	SON
2	0x04	0x08	0x09	0x10	0x04	0x04	0x08	0x08	-
	CCLR	CTRG	TRQLM	SPDLM	CCLR	CCLR	CTRG	CTRG	
3	0x16	0x11	0x14	0x16	0x14	0x16	0x11	0x11	0x14
	TCM0	POS0	SPD0	TCM0	SPD0	TCM0	POS0	POS0	SPD0
4	0x17	0x12	0x15	0x17	0x15	0x17	0x12	0x12	0x15
	TCM1	POS1	SPD1	TCM1	SPD1	TCM1	POS1	POS1	SPD1
5	0x02	0x02	0x02	0x02	-	-	0x14	0x16	0x16
	ARST	ARST	ARST	ARST	-	-	SPD0	TCM0	TCM0
6	0x22	0x22	0x22	0x22	-	-	0x15	0x17	0x17
	NL	NL	NL	NL			SPD1	TCM1	TCM1
7	0x23	0x23	0x23	0x23	0x18	0x20	0x18	0x20	0x23
	PL	PL	PL	PL	S-P	T-P	S-P	T-P	PL
8	0x21	0x21	0x21	0x21	0x21	0x21	0x21	0x21	0x21
	OVRD	OVRD	OVRD	OVRD	OVRD	OVRD	OVRD	OVRD	OVRD
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-

NOTE: Please refer to section 3.5 for wiring (Method C7/C8).

NOTE: When P1.001.U=1, switching control modes will also switch the DI and DO function assignments.

The suggested DO signal is detailed in the table below (these are the default assignments when P1.001.U=1):

DO	PT/PR/Communication		Speed/Torque		Wiring Method (refer to 3.5.3)
	Assignment	Function	Signal	Function	
DO1	SRDY	Servo ready	SRDY	Servo ready	C5/C6
DO2	ZSPD	Zero motor speed	ZSPD	Zero motor speed	
DO3	HOME	Homing completed	TSPD	Target speed reached	
DO4	TPOS	Target position reached	TPOS	Target position reached	
DO5	ALRM	Servo alarm	ALRM	Servo alarm	

If the suggested DI/DO function cannot meet the application requirements, you can set the functions of DI1–10 and DO1–6 with the corresponding parameters listed in the following table. That is, you can specify the DI/DO functions by setting DI or DO code to the corresponding parameters.

DI Signal		Pin No.	Corresponded Parameter	DI Signal		Pin No.	Corresponded Parameter
Standard DI	DI1-	9	P2.010	Standard DI	DI6-	32	P2.015
	DI2-	10	P2.011		DI7-	31	P2.016
	DI3-	34	P2.012		DI8-	30	P2.017
	DI4-	8	P2.013		DI9-	29	P2.036
	DI5-	33	P2.014		DI10-	38	P2.037

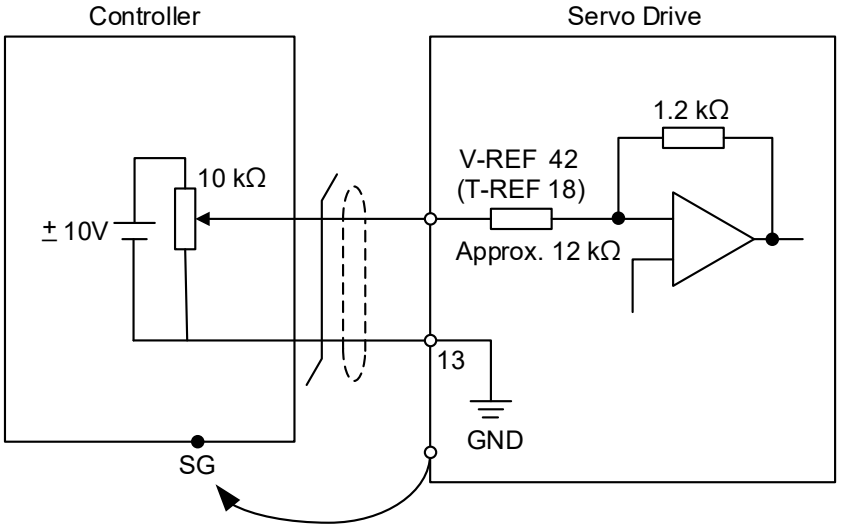
Do Signal		Pin No.	Corresponded Parameter	Do Signal		Pin No.	Corresponded Parameter
Standard DO	DO1+	7	P2.018	Standard DO	DO4+	1	P2.021
	DO1-	6			DO4-	26	
	DO2+	5	P2.019		DO5+	28	P2.022
	DO2-	4			DO5-	27	
	DO3+	3	P2.020		-		
	DO3-	2					

3.5 - Wiring Diagrams (CN1)

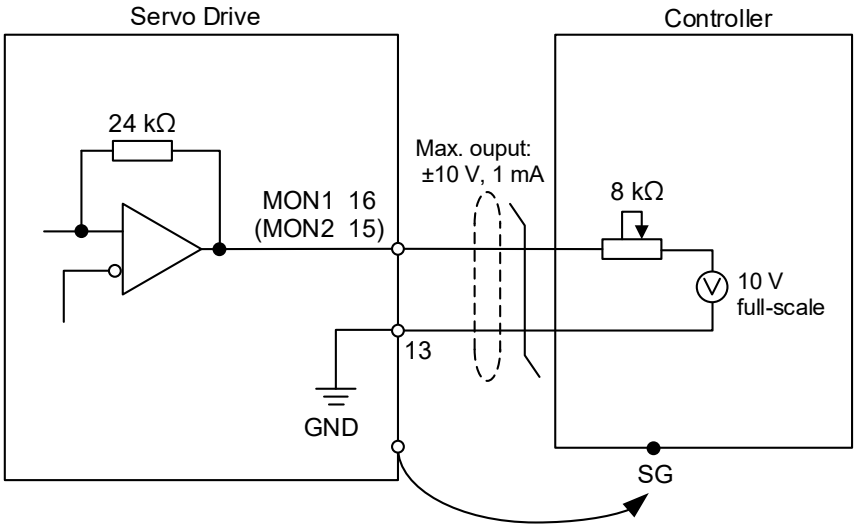
The valid voltage for the analog speed command and the analog torque command is between -10V and +10V. You can set the command value that corresponds to the voltage range with the relevant parameters.

3.5.1 - Analog Input/Output Suggested Wiring

C1: input for speed/torque (force) analog command



C2: output for analog monitoring command (MON1 and MON2)

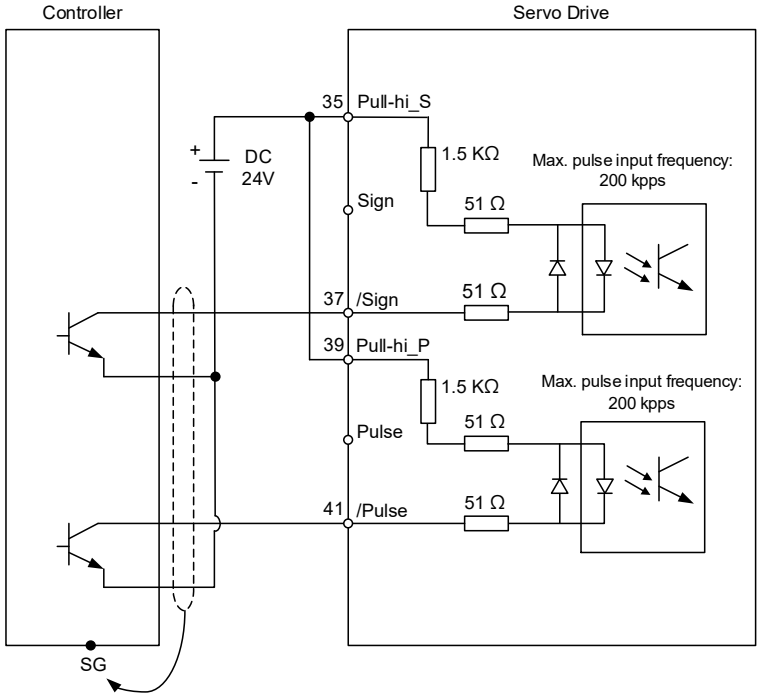


3.5.2 - Pulse/Sign Suggested Wiring

You can input the Pulse command with the open-collector or line driver. The maximum input pulse for the line driver is 4Mpps and 200kpps for open-collector.

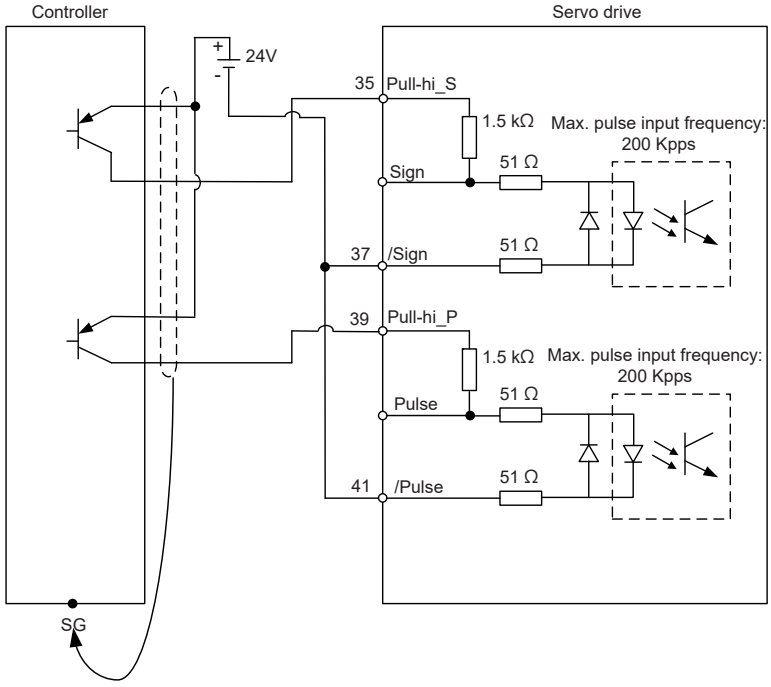
C3-1:

The source for the pulse input below is open-collector NPN (SINK) type, which uses an external power supply.



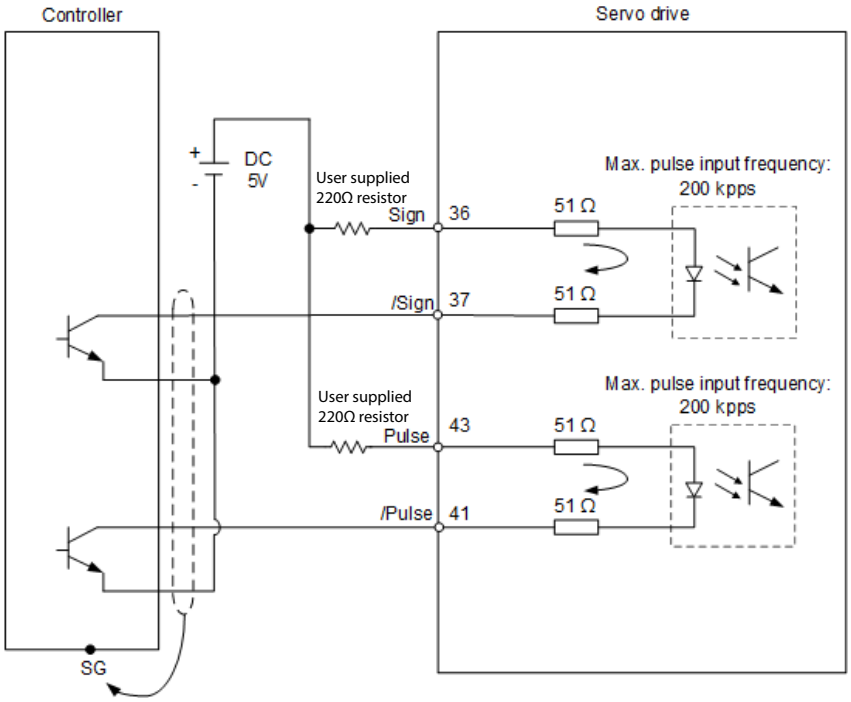
C3-2:

The source for the pulse input below is open-collector PNP (SOURCE) type, which uses an external power supply.



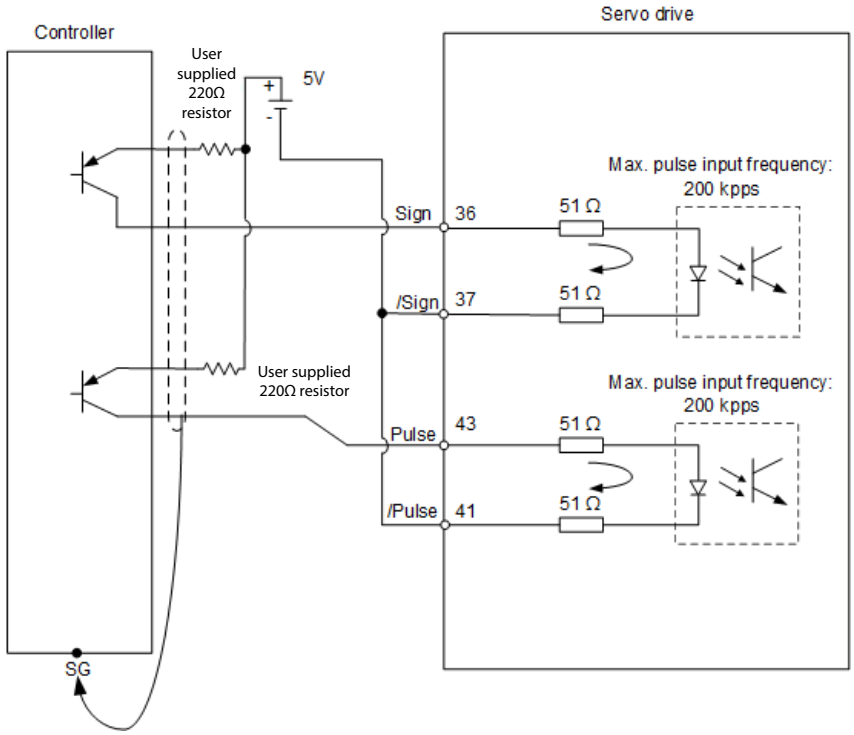
C3-3:

The source for the pulse input below is open-collector NPN (SINK) type, which uses an external power supply. Use a 220 Ohm resistor to limit the current, otherwise the drive will be damaged.



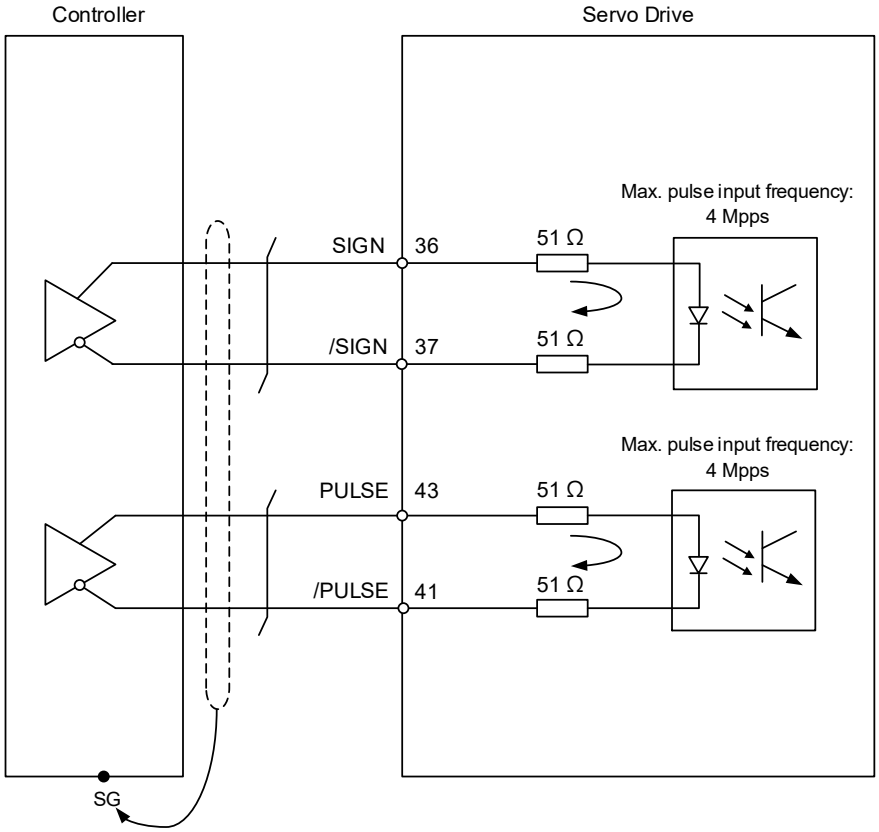
C3-4:

The source for the pulse input below is open-collector PNP (SOURCE) type, which uses an external power supply. Use 220 Ohm resistor to limit the current, otherwise the drive will be damaged.



C4:

The SIGN and PULSE inputs are designed for Line Driver (differential input) as shown below. Do not use terminals 36 and 43 with 24V power.

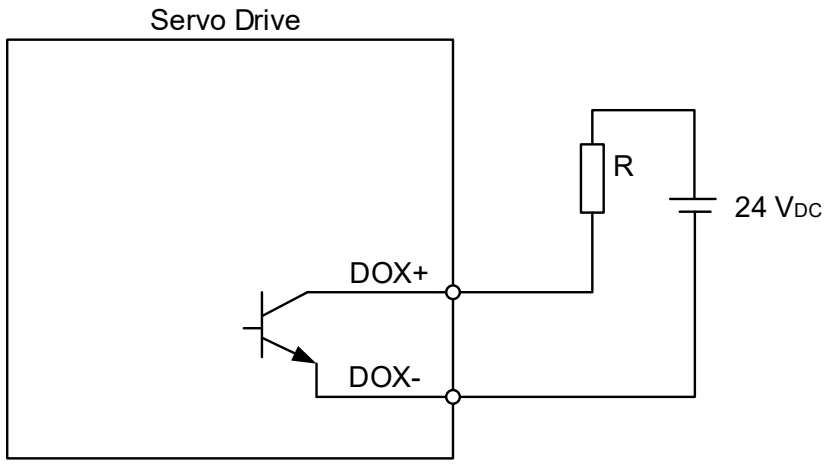


3.5.3 - Digital Output Suggested Wiring

When the drive connects to an inductive load, you must install the diode (permissible current: below 40mA; surge current: below 100mA; maximum voltage: 30V). A 5VDC source will also work as long as the continuous current does not exceed 40mA.

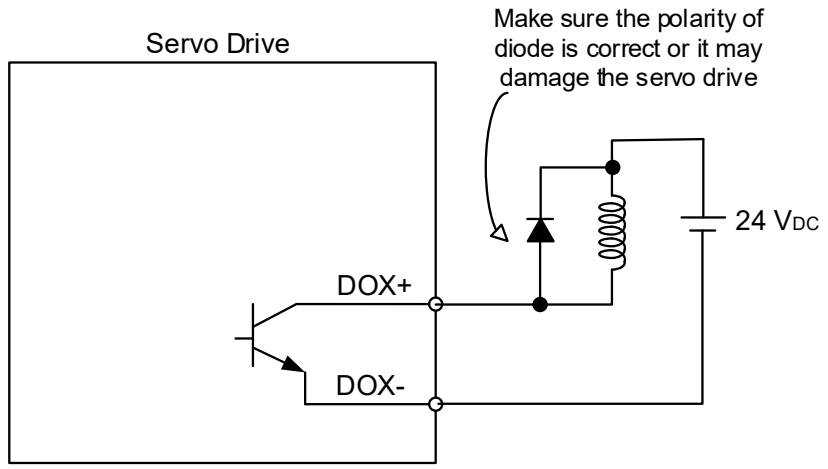
C5:

DO wiring - servo drive using an external power supply and a resistive load.



C6:

DO wiring - servo drive using an external power supply and an inductive load.



3.5.4 - Digital Input Suggested Wiring

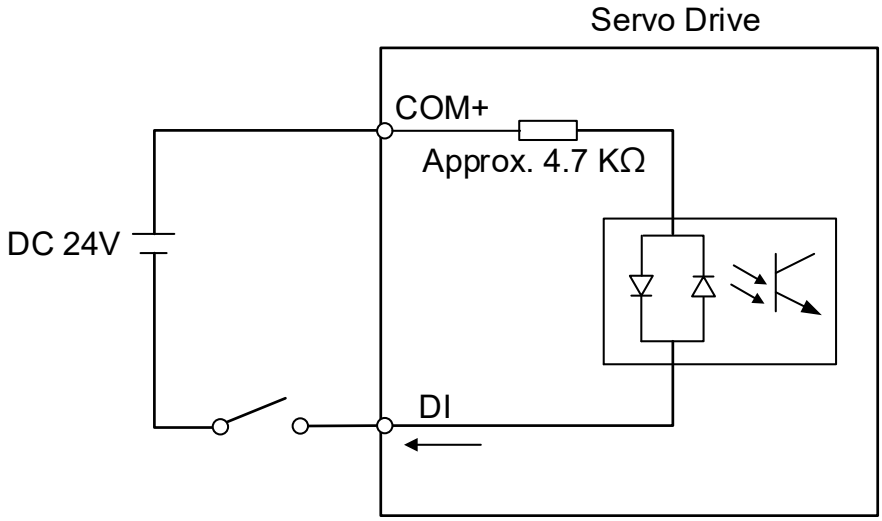
DI wiring - Input signals by relay or open-collector transistor. Maximum input frequency for all DI is 1kHz, not including Pulse and Sign.

Conditions of DI On/Off:

- *ON: 15V – 24V; Condition: Input current = 8mA*
- *OFF: below 5V; the input current must not be higher than 0.5 mA.*

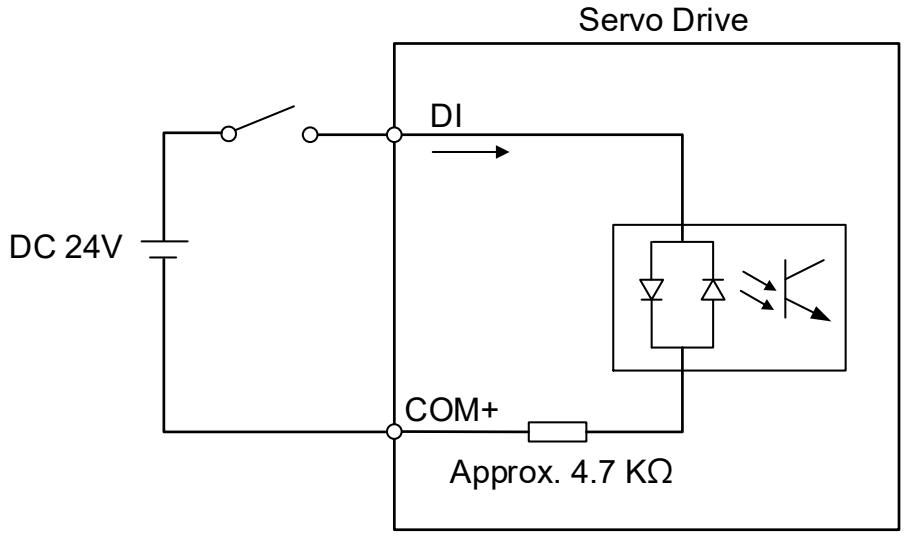
C7:

NPN sensor (SINK mode)



C8:

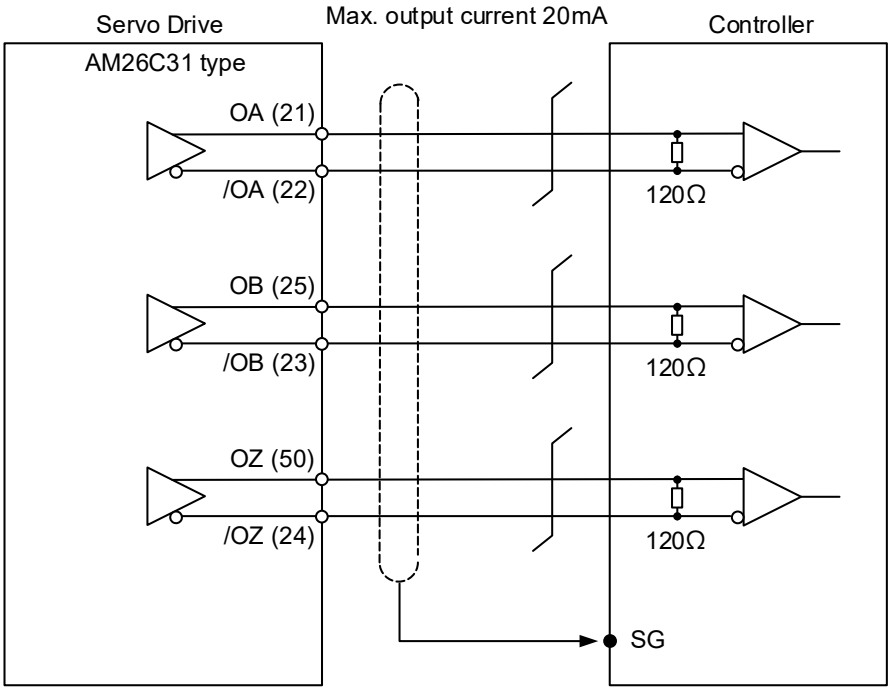
PNP sensor (SOURCE mode)



3.5.5 - Encoder Output Suggested Wiring

C9:

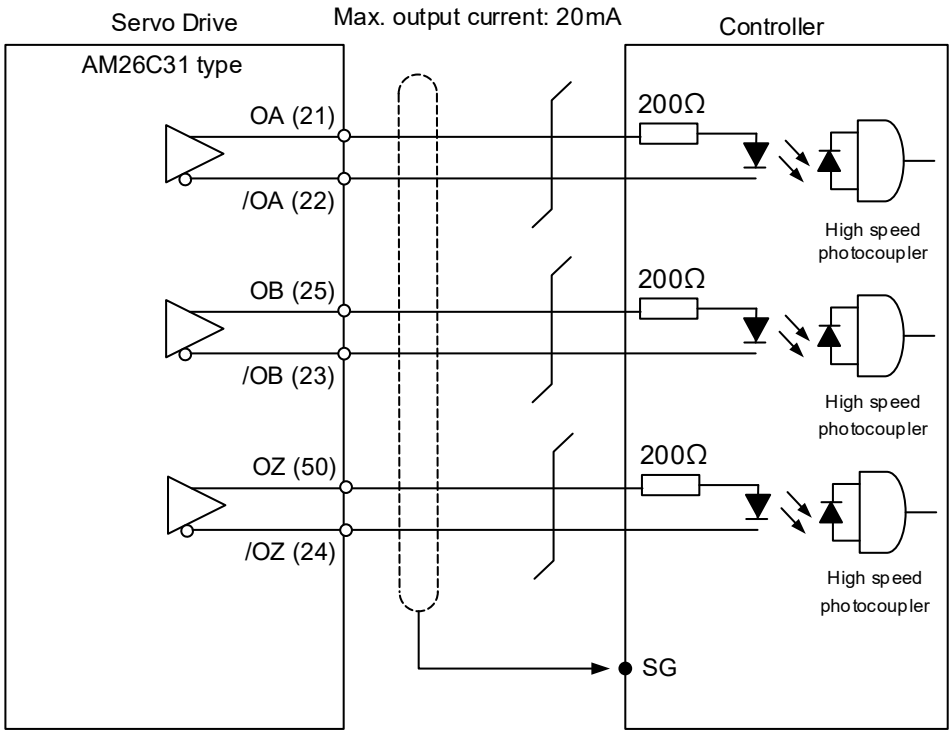
Output for encoder position signal (Line driver)



NOTE: Connect the two grounds of the controller and servo drive when the voltage ground potential is not the same for the controller and the servo drive.

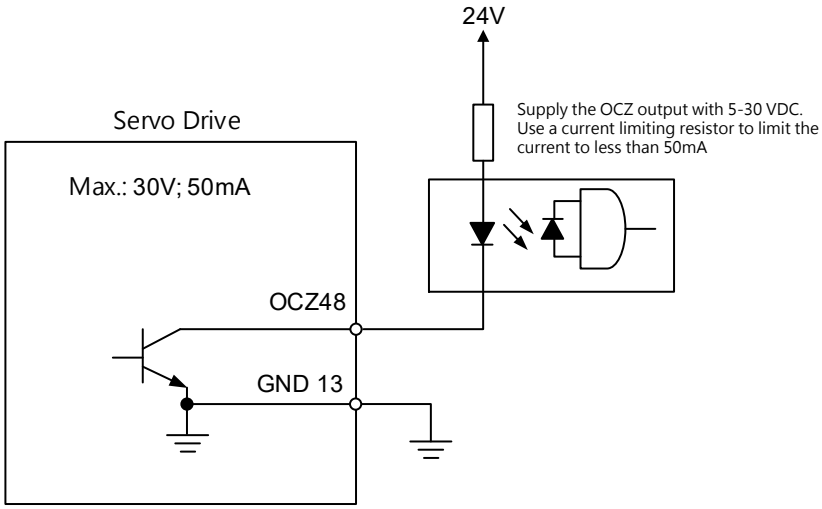
C10:

Output for encoder position signal (Opto-isolator)



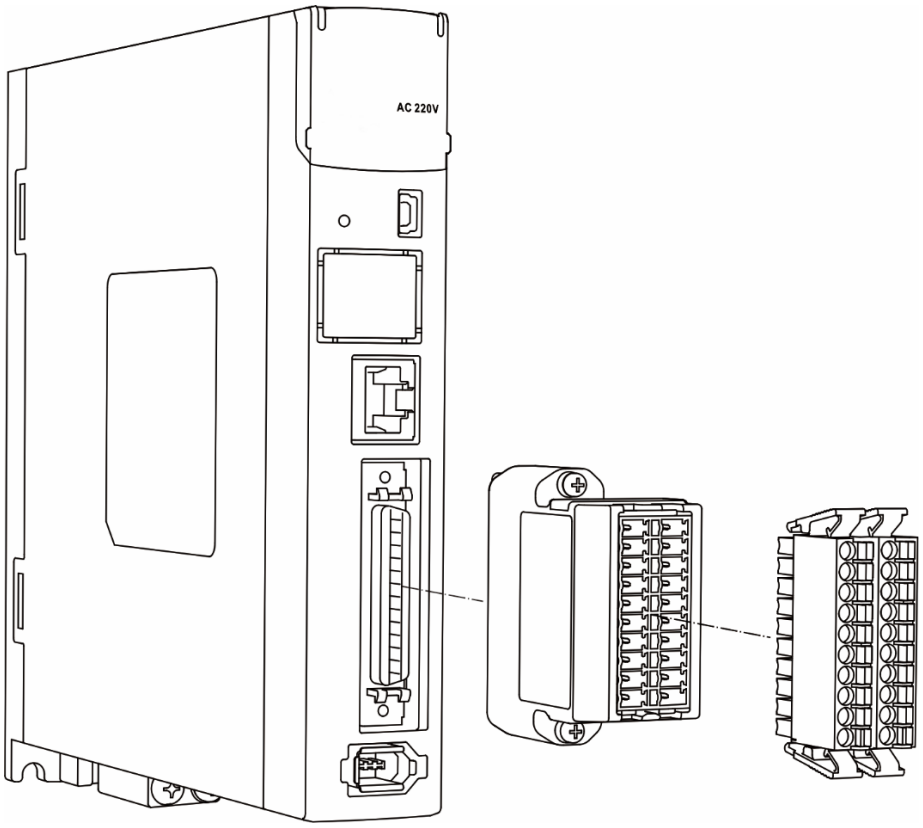
C11:

Encoder OCZ output (open-collector Z pulse output)



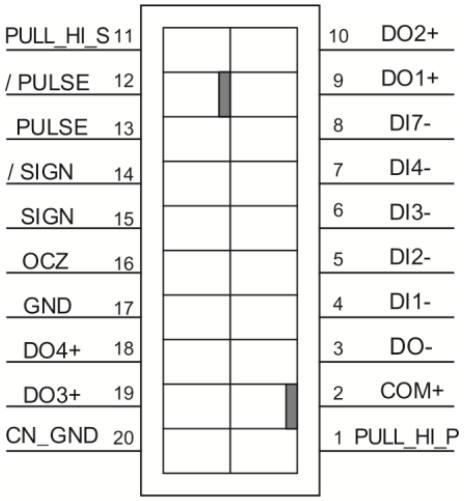
3.5.6 - Application: Using the CN1 Quick Connector for Wiring

The CN1 quick connector (SV2-CN1-LTB20) is designed for easy wiring. It can satisfy most needs of different DI/O applications. It is a good choice if you do not want to solder the wires or use up more panel space with the SV2-CN1-RTB50. Its spring terminal blocks prevent vibration from loosening the wire. It includes five digital inputs, four digital outputs, differential pulse command inputs and Z phase open-collector outputs.

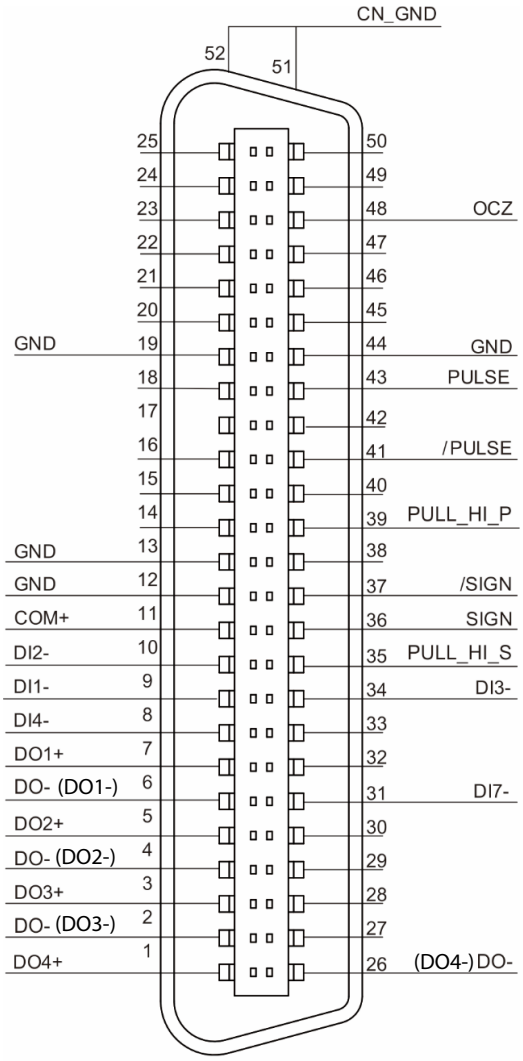


Pin assignment for the CN1 local terminal block (J2 and J1):

J2



J1



Note: *The LTB20 connector has internal jumpers that connect multiple terminals from the 50-pin connector to one pin on the LTB20 connector.*

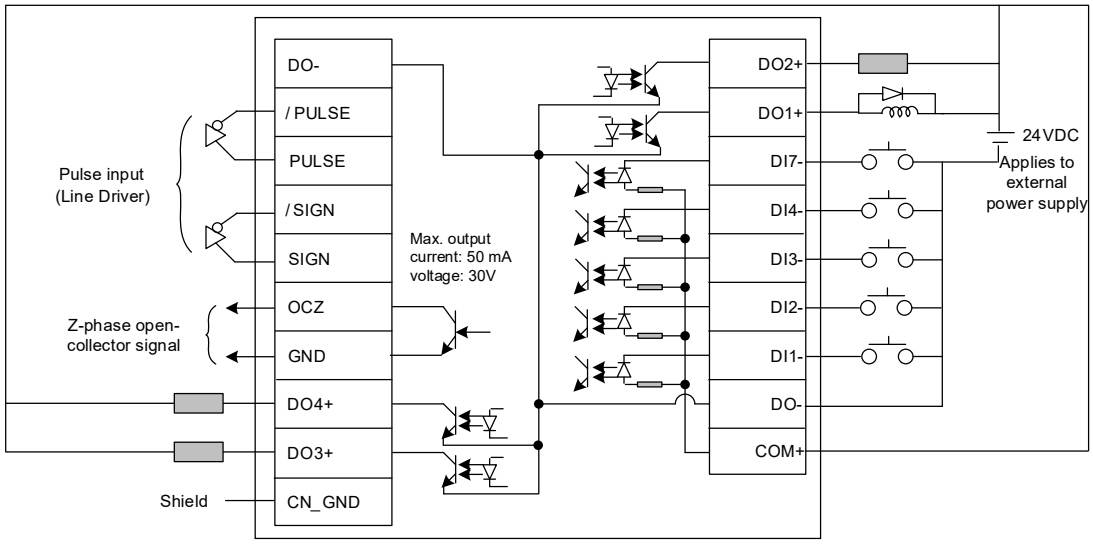
LTB20	***Internally- Jumpered CN1***
DO-	*DO1-, DO2-, DO3-, DO4-*
GND	*12, 13, 19, 44*

Combining the Digital Output commons results in one common for all 4 outputs (each output must use the same DC common if using the LTB20).

J2-PIN	***Signal***	***J1-PIN***
1	PULL_HI_P	39
2	COM+	11
3	DO-	2, 4, 6, 26
4	DI1-	9
5	DI2-	10
6	DI3-	34
7	DI4-	8
8	DI7-	31
9	DO1+	7
10	DO2+	5
11	PULL_HI_S	35
12	/PULSE	41
13	PULSE	43
14	/SIGN	37

J2-PIN	Signal	J1-PIN
15	SIGN	36
16	OCZ	48
17	GND	12, 13, 19, 44
18	DO4+	1
19	DO3+	3
20	CN_GND	Connector Shell (GND)

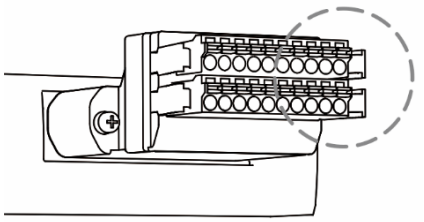
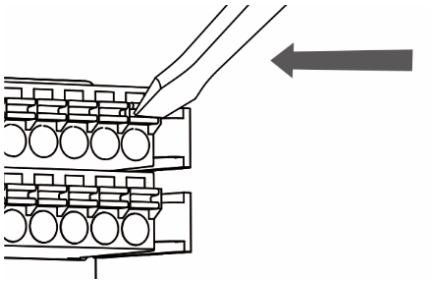
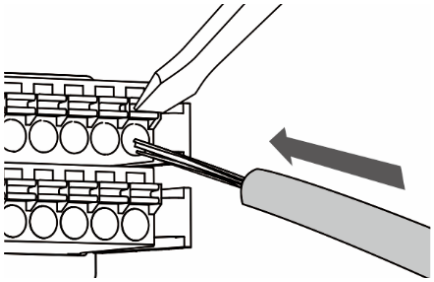
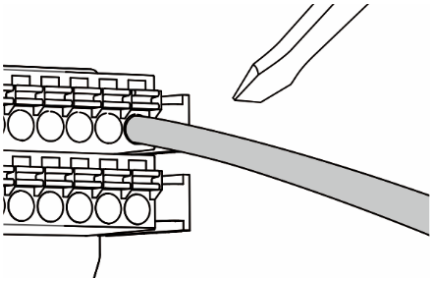
Wiring Example:



Circuitry internal to the drive and SV2-CN1-LTB20

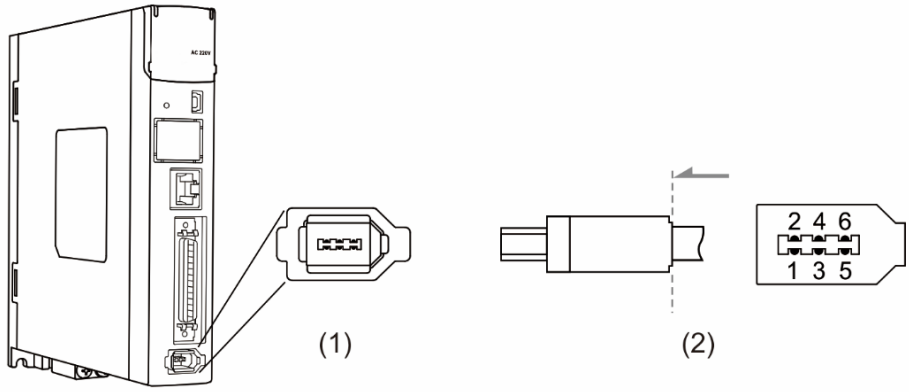
Wiring for CN1 quick connector and installation:

Wiring

	1. The CN1 quick connector has multiple spring terminals. Please determine which terminal is to be wired in advance.
	2. Use a flathead screwdriver to press the spring down to open the pin.
	3. Insert the stripped wire into the pin (18AWG to 22AWG acceptable).
	4. Withdraw the screwdriver to complete the wiring.

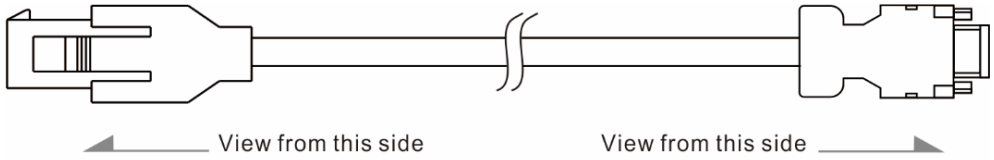
3.6 - Wiring for the CN2 Encoder Connector

The CN2 encoder signal connector is shown below:

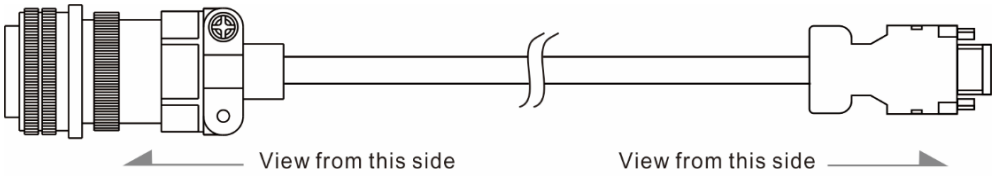


(1) CN2 connector (female) (2) CN2 connector (male)

Quick connector ends (SV2C-E122-xxxN):



Military connector ends (SV2C-E222-xxxN):

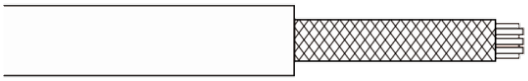
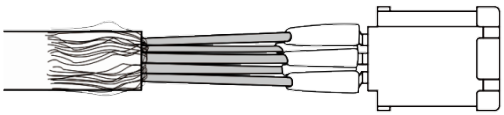
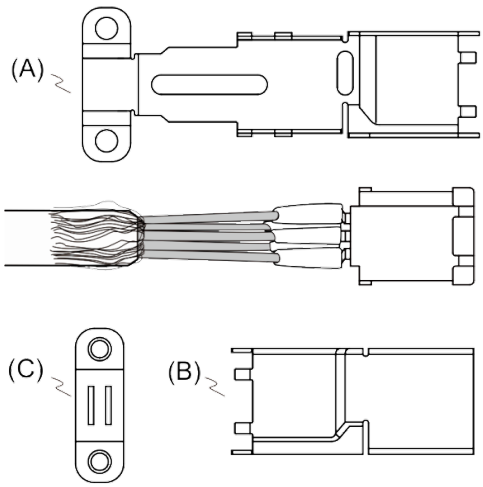
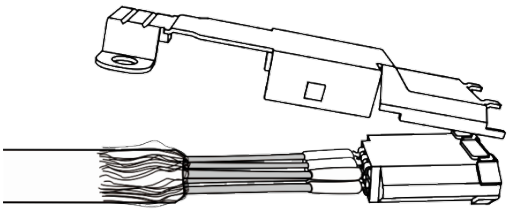


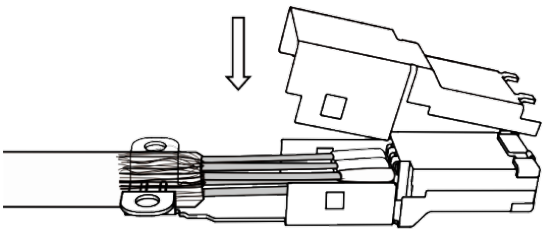
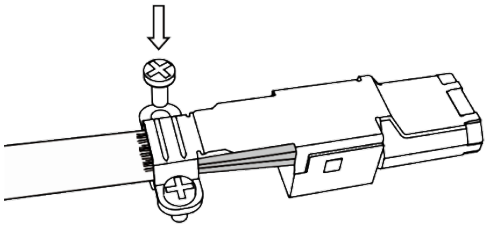
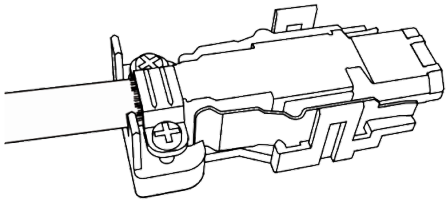
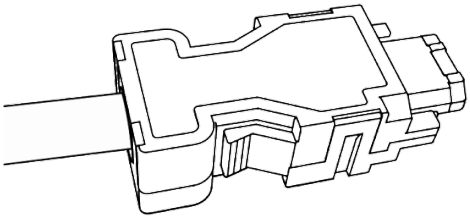
CN2 pin assignment:

Encoder End			Servo Drive End		
Military Connector	***Quick Connector***	***Color***	***Pin No.***	***Symbol***	***Description***
A	1	White	5	T+	Serial communication signal (+)
B	4	White / Red	6	T-	Serial communication signal (-)
S	7	Brown	1	+5V	+5V power supply
R	8	Blue	2	GND	Power ground
L	9	-	Case	Shielding	Shielding

NOTE: When using a battery box, the battery directly supplies the power to the encoder. Please refer to the detailed wiring description in section 3.2.2.

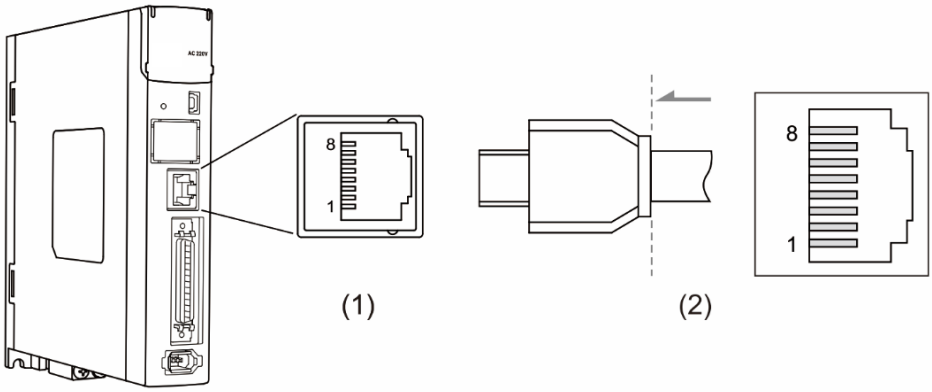
Connecting shielded wire to the CN2 encoder connector is shown below. The maximum reliable CN2 encoder length for CN2 wiring is 20 meters.

	1. Cut through the cable and expose the shielding. The exposed wire length should be 20 – 30 mm..
	2. Spread the metal shielding and fold it back. Refer to the CN2 pin assignment (see the table above) to connect the pins.
	3. You need the following items to assemble the connector: (A) Big metal case (B) Small metal case (C) Metal ring
	4. Place the metal case to cover the exposed wire shielding. Make sure the shielding is completed covered to maintain the integrity of the shielding. .

	5. Fasten the other side of the metal case.
	6. Tighten the screws of the metal case.
	7. Fit one side of the plastic case over the connector.
	8. Place and fasten the other side of the case to complete the connector.

3.7 - Wiring for the CN3 connector (RS-485)

When the servo drive is connected to the PC via CN3, you can operate the servo drive, PLC, or HMI through MODBUS. The CN3 connector supports RS-485 communication only. This enables you to connect multiple servo drives simultaneously.



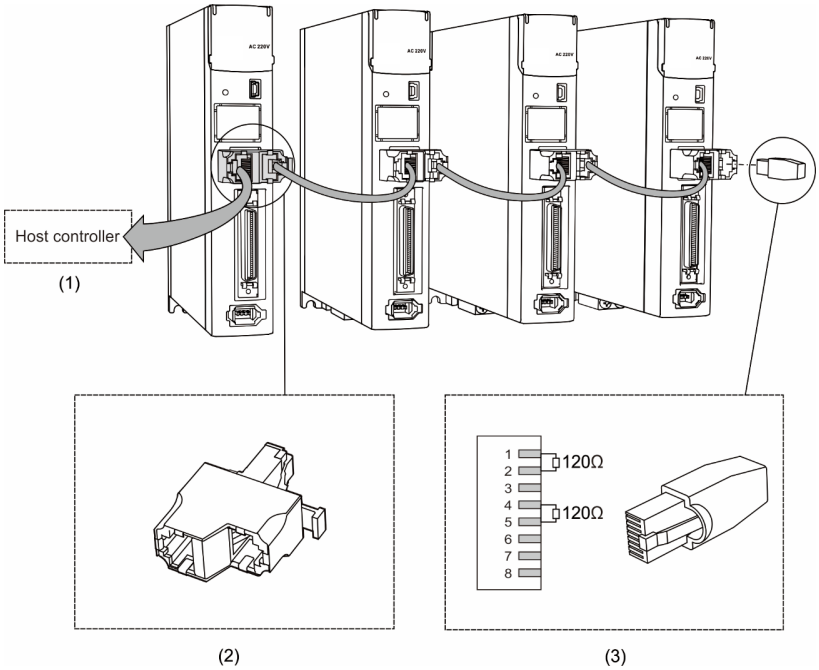
(1) CN3 connector (Female) (2) CN3 connector (Male)

Pin assignment:

Pin Number	Signal	Function
1	-	-
2	-	-
3, 7	GND_ISO	Signal ground
4	RS-485-	The servo drive transmits the data to differential terminal (-)
5	RS-485+	The servo drive transmits the data to differential terminal (+)
6, 8	-	-

NOTE: Please refer to Chapter 9 for RS-485 wiring.

Connecting multiple servo drives:



1) Connect to the controller/PLC.
2) Modbus RJ45 splitter SV2-CN3-CON-2
3) RS-485 terminating resistor (SV2-CN3-TR2)

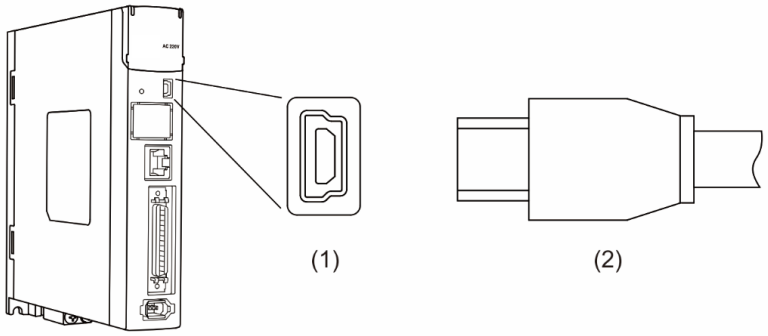
Notes:

1) This supports up to 32 axes via RS-485. The communication quality and the connectable axes are determined by the controller's specifications, quality of wires, grounding, interference, and whether the twisted-pair cable with shielding is used.
2) Use a terminal resistor of 120Ω (ohm) and 0.5 Watts or more.
3) To connect multiple servo drives, please use RS-485 connectors as shown above and put the terminating resistor in the last servo drive.

3.8 - CN4 Serial Connector (Mini USB)

CN4 is a serial connector that connects to a PC and allows you to operate the servo drive with the software. This is a Type B Mini-USB that is compatible with the USB 2.0 specification.

Note: when there is high EMI interference during operation, it is suggested that you install the USB isolator that is included with PN# SV2-PGM-USB15 and SV2-PGM-USB30. The USB connection supplies enough power to configure the drive w/o having AC power supplied. However, the USB Isolator will NOT work without control power supplied to the drive's L1c/L2c terminals.



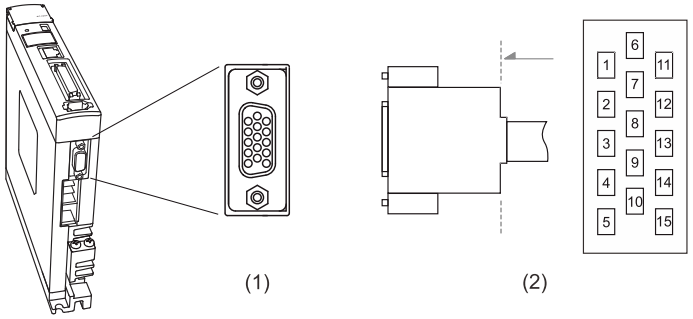
(1) USB connector (female) (2) USB connector (male)

3.9 - CN5 Connector

For machine position feedback, applicable to full-closed loop (sometimes called a dual closed looped). A full-closed loop servo system refers to one that has a secondary external encoder feedback for closing the position loop of the feedback algorithm versus relying on the motor encoder for position. This is useful when very high precision is needed in positioning the load. This external encoder is often a linear tape encoder (linear scale) and directly detects the position of the load. Some other examples of using an external linear scale are removing backlash from the performance of the application or compensating for lead screw pitch error.

A half-closed loop (or semi-closed) is what almost all servo motor applications use. The velocity and position loops are both closed using the encoder on the back of the motor. If you are unsure if you need a linear tape encoder for your application then most likely you do not.

The CN5 connects to an external encoder (A, B, and Z) and forms a full-closed loop with the servo system.



(1) CN5 connector (female) (2) CN5 connector (male)

Pin assignment:

Pin Number	Color	Signal	Function
1	Black/White	Opt_/Z	/Z phase input
2	Blue/White	Opt_/B	/B phase input
3	Blue	Opt_B	B phase input
4	Green	Opt_A	A phase input
5	Green/White	Opt_/A	/A phase input
6	Yellow/Black	0V/GND	Encoder grounding
7	Red/White	0V/GND	Encoder grounding
8	Red	+5V	Encoder power
9	Black	Opt_Z	Z phase input
10	Orange	Reserved	Reserved
11	Orange/White	Reserved	Reserved
12	Brown	Reserved	Reserved
13	Brown/White	Reserved	Reserved
14	Purple	Reserved	Reserved
15	Purple/White	Reserved	Reserved

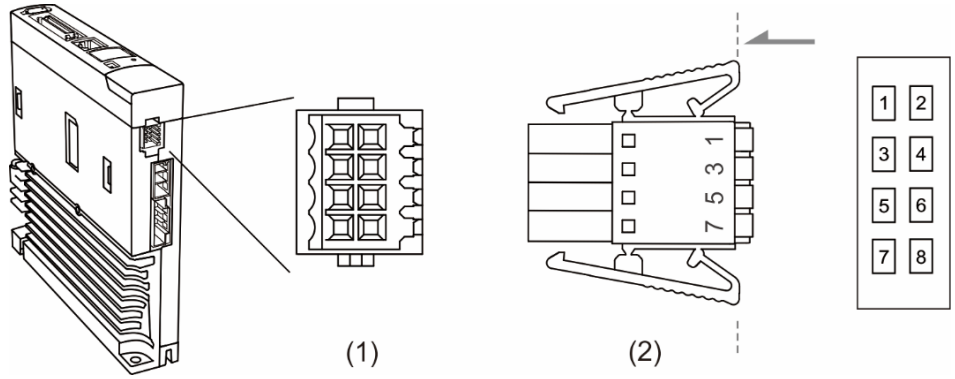
NOTE: This only supports AB phase signal and an encoder of 5V. The maximum single-phase (Phase A or Phase B) pulse frequency for the encoder cannot exceed 1MHz.

NOTE: Use ZL-HD15M-CBL-DB15F cable + ZL-RTB-DB15 ZIPLink breakout board, or use ZL-HD15M-CBL-2P cable (HD15 to flying leads).

WARNING: Do not use a standard VGA HD15 cable. The typical VGA cable does not include a connection on pin 8.

3.10 - CN10 STO Connector (Safe torque off)

This connector provides the STO function. More details are provided in the next section. Allowable wire gauges are 16–24 AWG.

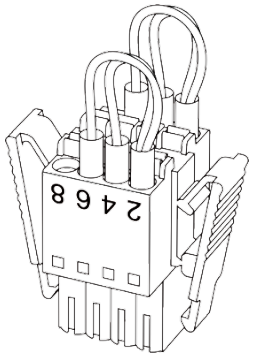


(1) CN10 STO connector socket (female) (2) CN10 quick connector plug (male)

Pin assignment:

Pin Number	Signal	Description	Usage Notes
1	Reserved	Reserved	For deactivating the STO function. Do not connect these two pins if using the STO function is required.
2	Reserved	Reserved	
3	STO_A (SF1+)	STO input A+ (safety input 1+)	Input signal for the STO function. ON (close): servo drive is in normal operation OFF (open): STO is activated.
4	/STO_A (SF1-)	STO input A- (safety input 1-)	
5	STO_B (SF2+)	STO input B+ (safety input 2+)	
6	/STO_B (SF2-)	STO input B- (safety input 2-)	
7	FDBK+ (EDM+)	STO alarm output (+)	Monitoring outputs for STO input status and STO circuit failure. BJT Output Max.rating: 80VDC, 0.5 A
8	FDBK- (EDM-)	STO alarm output (-)	

If you choose to not use the STO function then you can use the STO connector plug to bypass this safety feature. The STO connector is included with each drive and can also be purchased as a spare (PN# SV2-CN10-STO). The default wiring has been done as shown in the figure on the right. The wiring diagram can be seen in section "3.11.3 - Wiring for STO" on page 3–42. If external safety control is needed and is intended for the STO function then please refer to section 3.11 STO Function (Safe Torque Off) for sample wiring information.

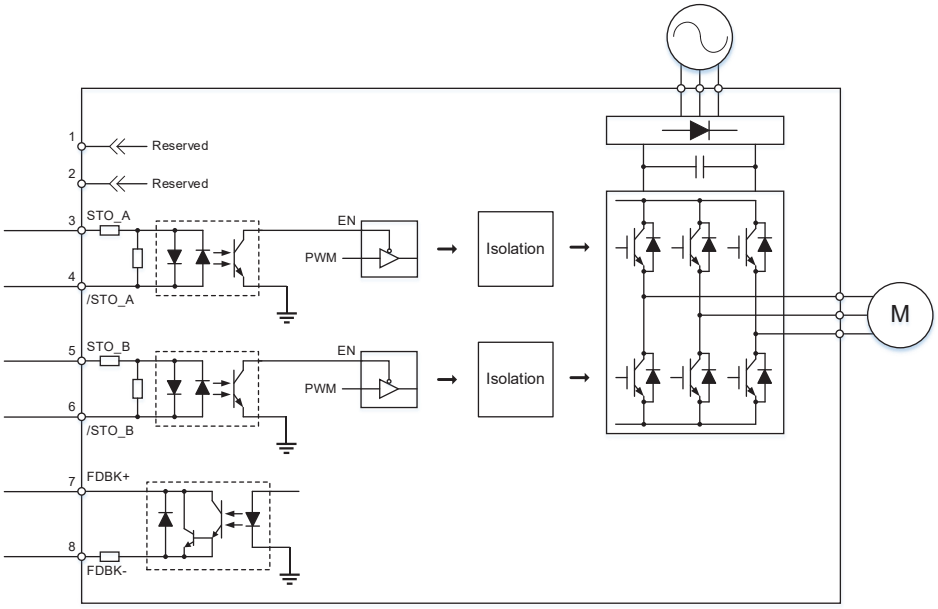


NOTE: The alloweable wire size is 16-24 AWG.

3.11 - STO function (Safe torque off)

3.11.1 - Introduction to STO

Once the STO function is activated, the servo drive stops supplying current to the motor, cutting off the power supply and torque force. Do not repeatedly use this function unnecessarily. It cannot control the time it takes for the motor to stop once the power outputs to the motor are shut off. The STO function should never be used as a routine stop function.



3.11.2 - The potential dangers of STO and precautions for using STO

After the STO function is activated, the motor is no longer controlled by the servo drive and the motor movement is controlled solely by external forces such as existing spinning inertia, back driving, gravity, and external load forces.. Thus, the potential danger from STO must be taken into consideration when designing and wiring the machine. AutomationDirect is not liable for mechanical damage and personnel injury if you fail to observe the following instructions:

1) For a safety circuit design, make sure the selected components conform to the safety specifications.
2) Before installation, read the safety instructions for any external STO related components such as a safety relay.
3) To avoid electric shock, do not touch the servo drive even when the STO function is activated. Although the power to the motor is cut off, there is residual electricity since the power supply is not completely removed from the servo drive.
4) When the STO function is enabled, the servo drive can no longer control, stop or decelerate the motor.
5) After the STO function is activated, the servo drive no longer controls the motor, but the motor can still be moved by other external forces.
6) The feedback monitoring output signal (FDBK) is only for inspecting the STO function status rather than for safety output.
7) The STO function must be powered by the safety extra-low voltage (SELV) power source with reinforced insulation.
8) Power the STO signals with single power supply, or the leakage current will result in STO malfunction.
9) When performing maintenance on the servo drive, use a molded-case circuit breaker (MCCB) or a magnetic contactor (MC) to cut off the power.

10) Only qualified personnel fully understanding the safety standards can design, install, and operate the system after reading this operation manual.
11) Use products with safety certifications or machines compliant with safety specifications to build a safe electrical circuit.
12) Before installation and wiring, read the operation manuals of all the peripheral devices carefully.
13) If the motor is moved by external forces when the STO function is activated, take safety measures such as using the mechanical brake.
14) Evaluate the risk of using the machine or the connecting devices.
15) To avoid malfunction caused by accumulated errors, you must check the safety functions at least once every 3 months.

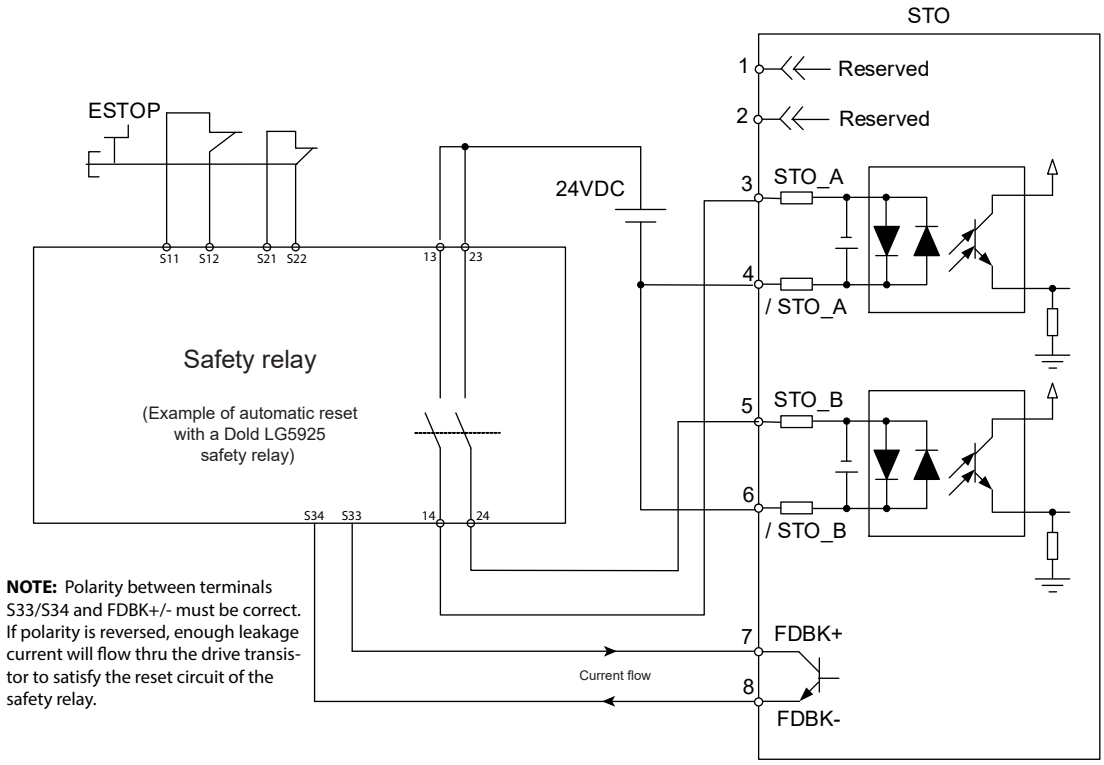
The SureServo2 series servo drive conforms to the following safety specifications:

Item	*Description*	*Standard*	*Safety Data*
SFF	Safe failure fraction	IEC61508	Channel1: 80.08% Channel2: 68.91%
HFT (Type A subsystem)	Hardware fault tolerance	IEC61508	1
SIL	Safety integrity level	IEC61508	SIL2
		IEC62061	SILCL2
PFH	Probability of dangerous failure per hour (h^{-1})	IEC61508	$9.56x10^{-10}$
PFD_{av}	Average probability of failure on demand	IEC61508	$4.18x10^{-6}$
Category	Category	ISO13849-1	Category 3
PL	Performance level	ISO13849-1	d
$MTTF_d$	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic coverage	ISO13849-1	Low

3.11.3 - Wiring for STO

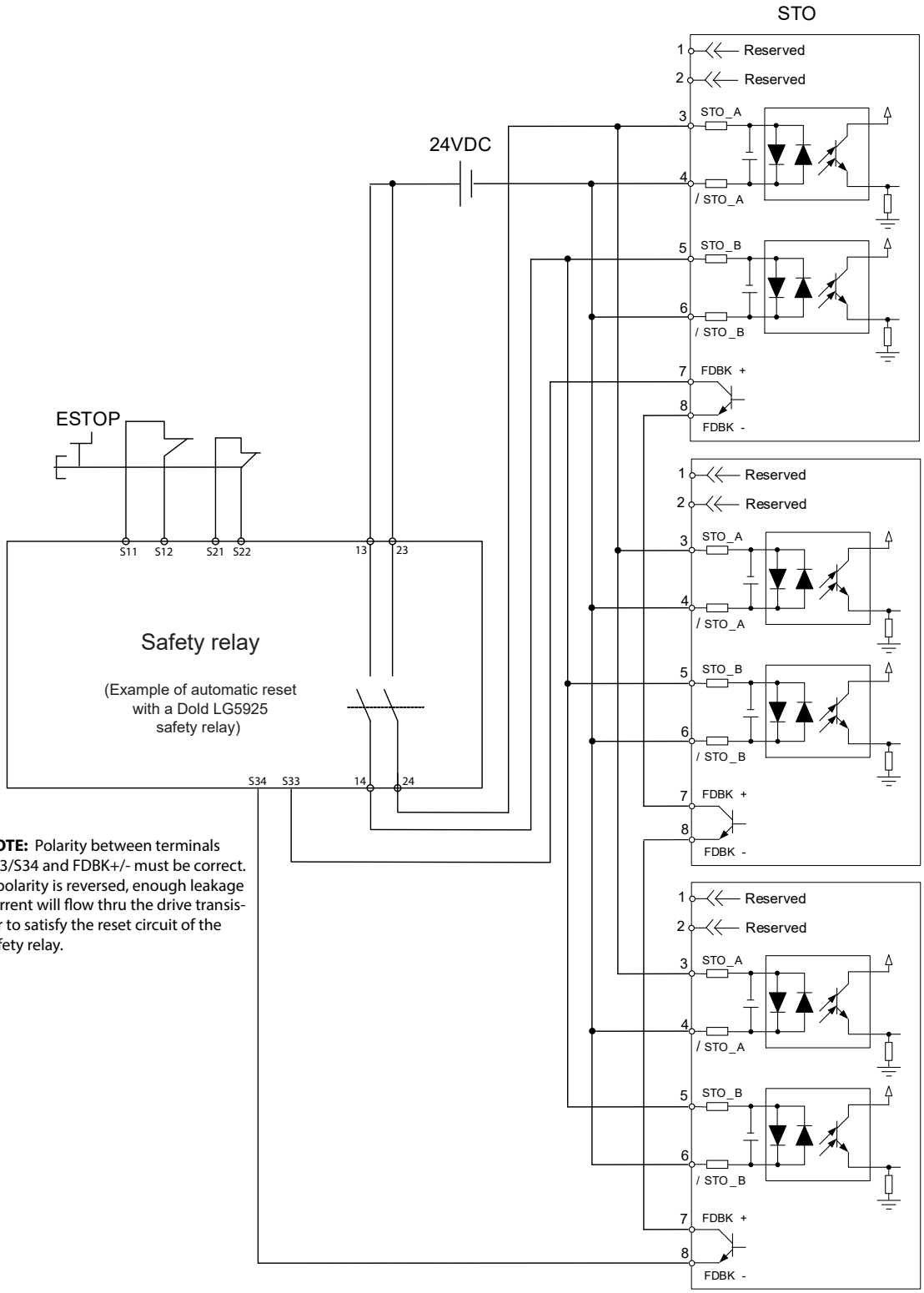
To use a safety relay to trigger the STO function, example wiring is shown in the following diagrams:

Single

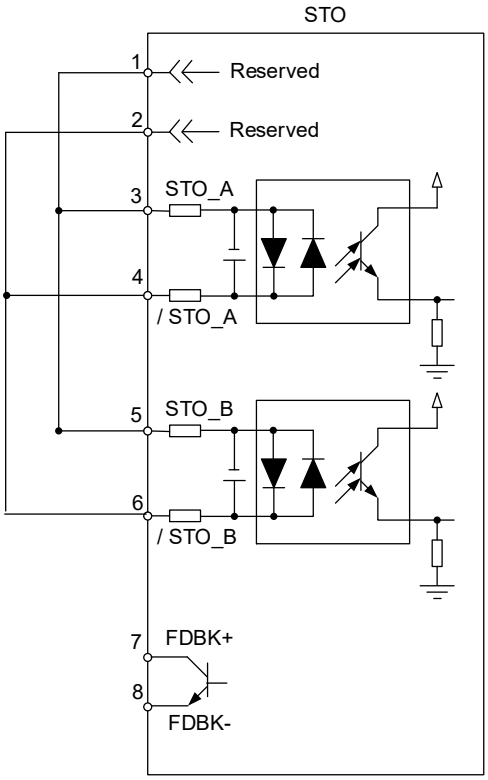


Multiple

In a multi-drive system, the values of (PFD x number of drives) and (PFH x number of drives) must not exceed the specified safety values of the device.



If you are not using the STO function, you can short-circuit the connector or plug in the connector that has been wired (provided with the servo drive).



3.11.4 - How does the STO function work?

The STO function is controlled by the motor current from two individual circuits. It cuts off the power supply to the motor when needed, after which the motor is free from the drive's torque force. The table below details how this function works.

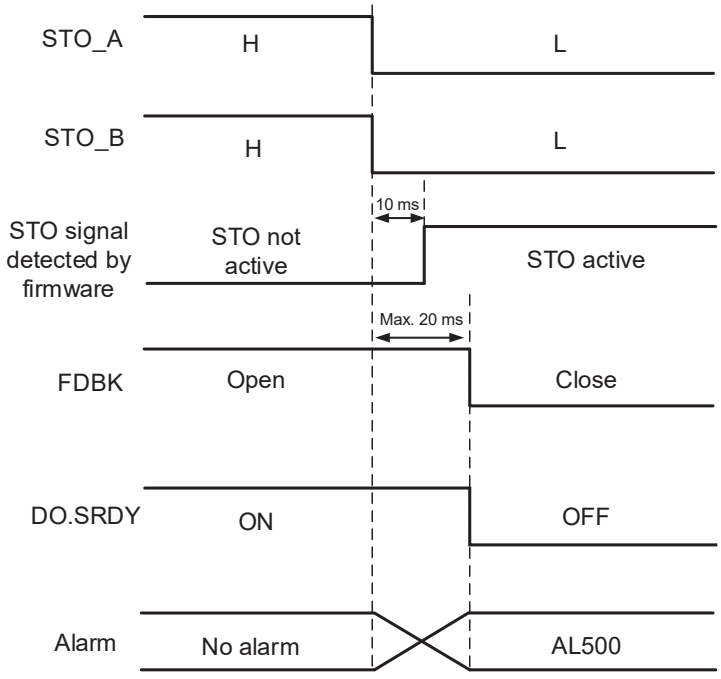
Signal	Channel	Status of Opto-isolator			
STO	STO_A /STO_A	ON	ON	OFF	OFF
	STO_B /STO_B	ON	OFF	ON	OFF
Servo Drive Output Status		Ready	Torque off (STO_B lost)	Torque off (STO_A lost)	Torque off (STO Mode)
Feedback monitoring (FDBK status)		Open	Open	Open	Close
Alarm		N/A	AL502	AL501	AL500

Note:

1) ON=24V, OFF=0V.
2) Open=open circuit, Close=closed circuit.
3) The status of the feedback monitoring signals changes at once according to the status of the safety signals (STO_A and STO_B signals).
4) Contact AutomationDirect if AL503 (STO self-diagnostic error) occurs. Refer to "Chapter 11: Troubleshooting" on page 11–1 for mopre details of the alarms.

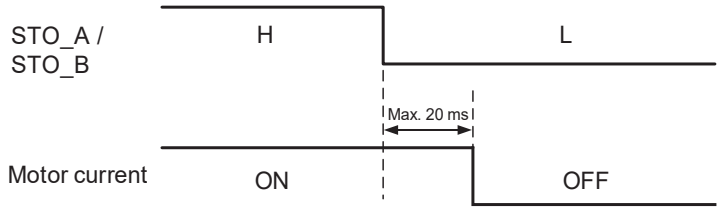
Description of the STO alarm:

See the diagram below. When the motor runs normally (Servo On), but both STO_A and STO_B signals are low for 10ms at the same time, AL500 occurs and the drive is in the Servo Off state.



3.11.5 - STO Response Time

When either STO_A or STO_B signal (safety signal source) is low, the circuit cuts off the motor current within 20 ms.

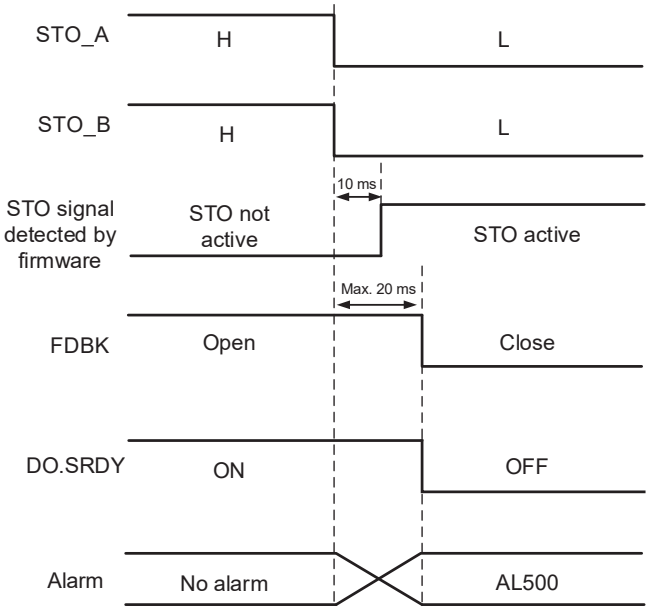


3.11.6 - Alarm Triggering

AL500 (STO function is activated)

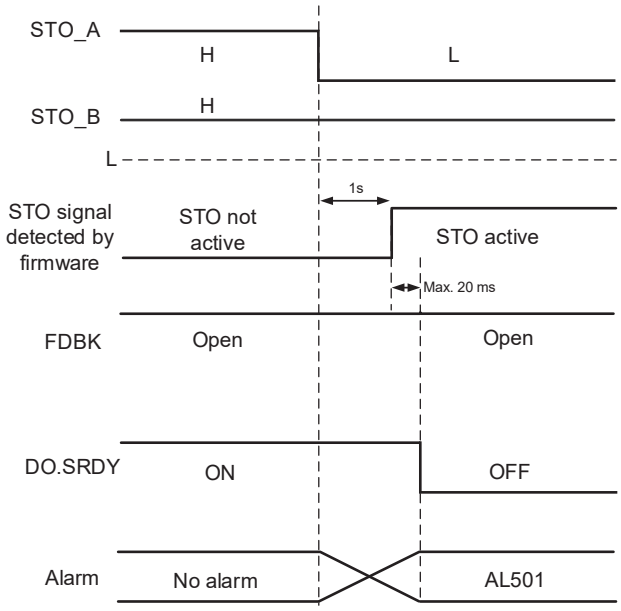
When either STO_A signal or STO_B signal becomes OFF, the STO function is activated, the circuit cuts off the current to the motor within 10ms, and the servo drive is Off, triggering AL500.

When both STO_A and STO_B signals become OFF, the servo drive still displays AL500. Refer to the following diagrams:



AL501 (STO_A lost) / AL502 (STO_B lost) (signal loss or signal error)

When either STO_A signal or STO_B signal becomes OFF, the STO function is activated, the circuit cuts off the current to the motor.



NOTE: When STO_A becomes OFF, AL501 occurs. When STO_B becomes OFF, AL502 occurs.

Notes:

1) Contact AutomationDirect if AL503 (STO self-diagnostic error) occurs.
2) Refer to section 3.11.4 on page 3–45 for the FDBK signal.

3.11.7 - STO Feedback Behavior

FDBK behavior

The FDBK signal is only configured for non-latching and is used for external device monitoring (EDM). There is no way to make it latch. Once the STO circuit is reset to the running state, the FDBK output will open. During an STO event when both channels A and B are open (AL500) the FDBK signal is closed. If only one channel opens or there is an internal STO error then the STO circuit will still remove power to the motor but the FDBK signal will remain open.

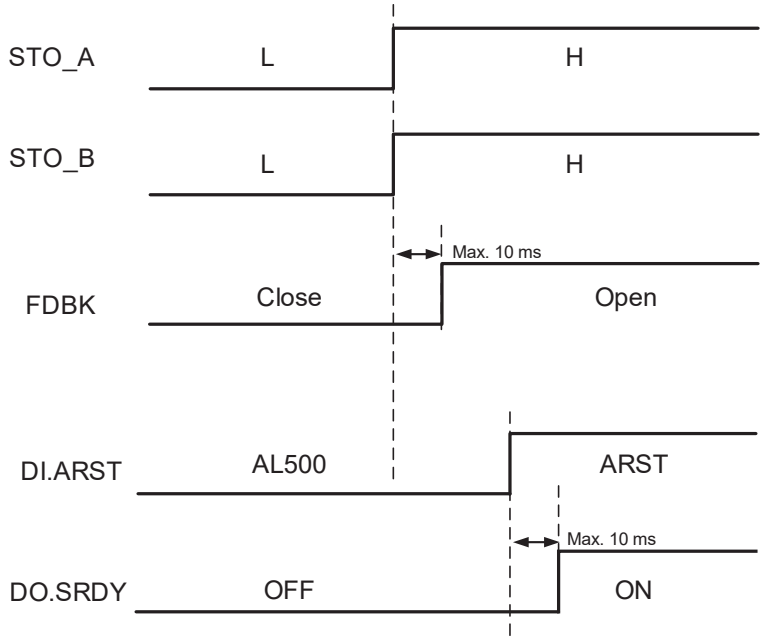
Example:

The FDBK status is closed when the safety signal is lost and AL500 occurs.

1) Since the FDBK signal is non-latching, when the safety signals return to normal, the FDBK status automatically changes from short-circuited to normal when AL500 occurs.
2) After the FDBK status is restored, you can clear the alarms by the normal corrective actions. In this case, you can clear AL500 by DI.ARST.

3.11.8 - Deactivation Status

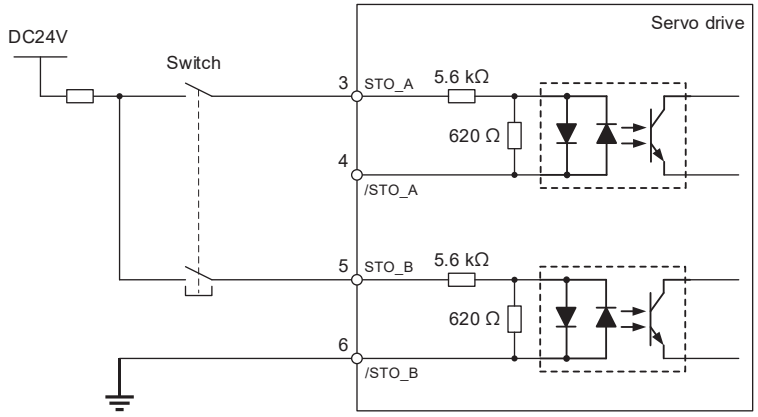
When the safety signal source (STO_A and STO_B signals) switches back to high, the alarm will not be cleared automatically. Of all the STO alarms, only AL500 can be cleared with DI.ARST.



NOTE: Refer to section 3.11.4 on page 3-45 for the FDBK signal.

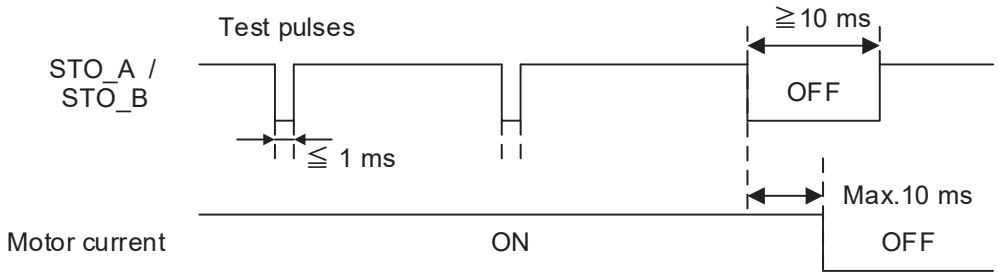
3.11.9 - Input/Output Signal Specification

Safety Input Signals (STO_A, /STO_A, STO_B, /STO_B)

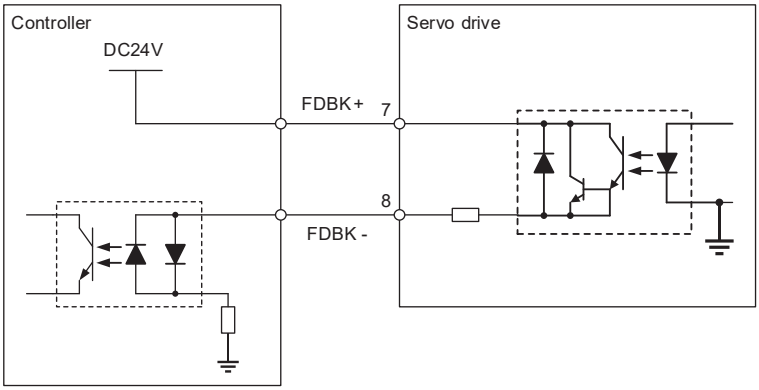


Item	Specification	Note
Internal impedance	5.6 kΩ	–
Operable voltage	24VDC ± 20%	Use the SELV power source.
Maximum delay time	10ms	The time duration from STO signal OFF to STO function activated.

The OFF time curation of the external test pulse input should be less than 1ms.



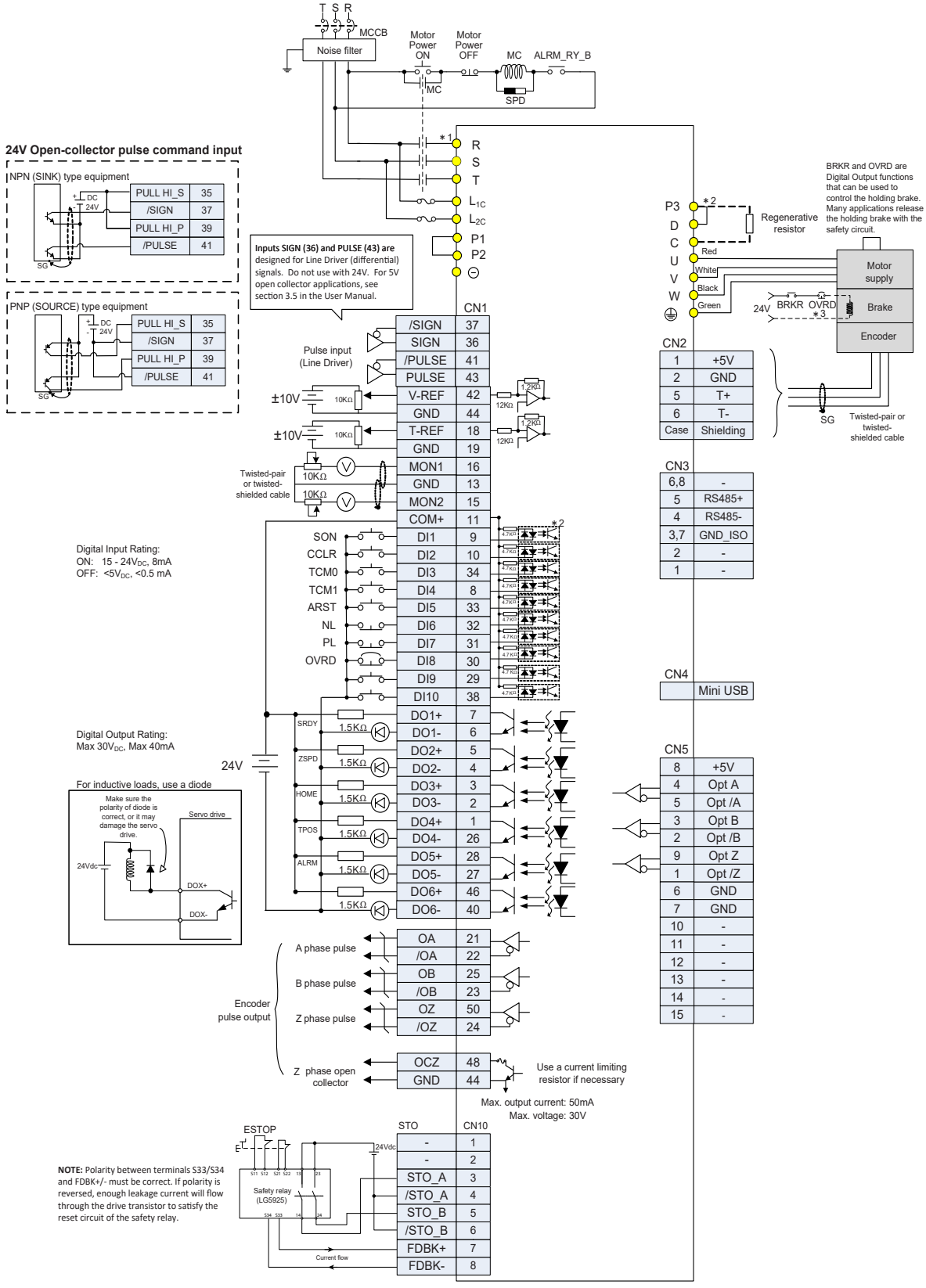
Diagnostic Output Signal (FDBK+, FDBK-)



Item	*Specification*	*Note*
Maximum allowable voltage	24VDC	Use the SELV power source.
Maximum alloweable current	50mA	–
Maximum voltage drop	1.5 V	When the current is 50mA.

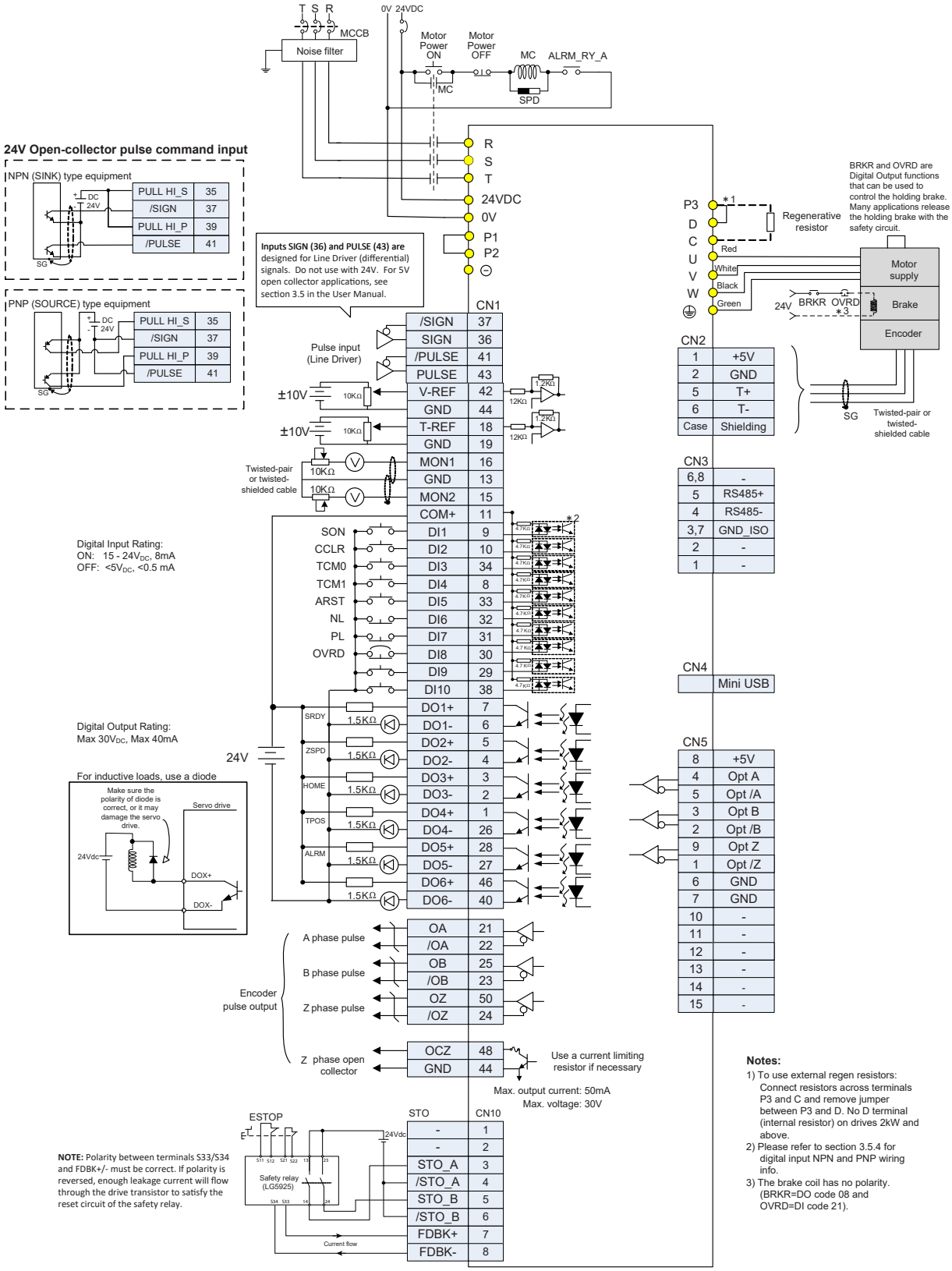
3.12 - Standard Wiring Example

110/230V Sytems



Notes: (see page 3–52)

460V Systems



Notes: (see next page)

Notes:

1) Please refer to section 3.5.1 for C4 wiring diagram.
2) Please refer to section 3.5.4 for wiring diagram C7 SINK / C8 SOURCE.
3) The motor's brake coil has no polarity.
4) Connect to Mini-USB (for PC communication).
5) Models of 2kW and below can use single-phase power supply.

3.12.1 - STO Safety Specifications

The SureServo2 series servo drive conforms to the following safety specifications:

Item	*Description*	*Standard*	*Safety Data*
SFF	Safe failure fraction	IEC61508	Channel1: 80.08% Channel2: 68.91%
HFT (Type A subsystem)	Hardware fault tolerance	IEC61508	1
SIL	Safety integrity level	IEC61508	SIL2
		IEC62061	SILCL2
PFH	Probability of dangerous failure per hour (h^{-1})	IEC61508	$9.56x10^{-10}$
PFD_{av}	Average probability of failure on demand	IEC61508	$4.18x10^{-6}$
Category	Category	ISO13849-1	Category 3
PL	Performance level	ISO13849-1	d
$MTTF_d$	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic coverage	ISO13849-1	Low